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Third Semester B.E. Degree Examination, Dec.2024/Jan.2025 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 atomic packing factor. Determine the atomic packing factor of an ideally packed HCP unit cell. (10 Marks)
b. Classify the different types of crystal imperfections. Sketch and explain the edge dislocation and screw dislocation. (10 Marks)

OR

- 2 a. Sketch and explain engineering stress-strain and true stress-strain diagram and explain the stages of fracture. (10 Marks)
b. Sketch and explain linear and non-linear elastic properties, when a material is subjected to static tension. (10 Marks)

Module-2

- 3 a. Sketch and explain Type – I, Type – II and Type – III fracture. (06 Marks)
b. Draw and explain S-N curve. (04 Marks)
c. Draw Fe-Fe₃C diagram and indicate the phase temperatures and also write the invariant reactions. (10 Marks)

OR

- 4 a. Explain the different types of solid solutions. (05 Marks)
b. Sketch and explain binary phase diagram. (05 Marks)
c. Sketch and explain mechanism of fatigue. Explain different types of fatigue loading with sketch. (10 Marks)

Module-3

- 5 a. Draw TTT diagram for eutectoid steel and explain briefly. (07 Marks)
b. Distinguish between Austempering and Martempering. (05 Marks)
c. Define Hardenability. Sketch and explain Jominy end quench test. (08 Marks)

OR

- 6 a. Distinguish between annealing and normalizing. (04 Marks)
b. Sketch and explain flame hardening and induction hardening process. (08 Marks)
c. Explain composition, properties and uses of grey cast iron and medium carbon steel. (08 Marks)

Module-4

- 7 a. Define composite material. Give its classifications. Explain metal matrix composites. (08 Marks)
b. Sketch and explain hand layup and spray layup process. (12 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. Derive an expression for Young's modulus for ISO-stress and ISO-strain condition. (12 Marks)
- b. Calculate the tensile modulus of elasticity of unidirectional carbon fibre-reinforced composite material which contains 62% by volume of carbon fibres in ISO-strain and ISO-stress condition.
- Where $E_{\text{carbon fibre}} = 37.86 \times 10^4 \text{ N/mm}^2$
 $E_{\text{Epoxy}} = 41.98 \times 10^2 \text{ N/mm}^2$
 Find Young's modulus of composite = $E_c = ?$ (08 Marks)

Module-5

- 9 a. Define ceramic. Explain the types of ceramics. (05 Marks)
- b. Distinguish between Thermo plastic and Thermo setting plastics. (05 Marks)
- c. Sketch and explain processing of plastic by Injection moulding method. (10 Marks)
- OR
- 10 a. Define smart material. Explain any four types of smart materials. (10 Marks)
- b. Explain, how the residual life assessment is done using different types of non destructive testing methods. (10 Marks)
