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Third Semester B.E. Degree Examination, July/August 2021 Material Science

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1
 - a. Define Atomic Packing Factor. Calculate APF for Face Cubic Centre (FCC) unit cell. (08 Marks)
 - b. Explain briefly points, line and surface defects, with neat sketches. (12 Marks)
- 2
 - a. With the help of stress – strain diagram, briefly explain the ductile and brittle behavior of Engineering Materials. (10 Marks)
 - b. Explain slip and twinning, with neat sketches. (10 Marks)
- 3
 - a. List different types of fatigue loading with examples. (04 Marks)
 - b. Explain with a neat sketch, the different stages of creep. (08 Marks)
 - c. What is meant by Stress Relaxation? Derive an expression for the stress relaxation. (08 Marks)
- 4
 - a. Construct and label the Iron – Carbon equilibrium diagram and explain briefly. (10 Marks)
 - b. What is Nucleation? Explain homogeneous nucleation in solidification. (10 Marks)
- 5
 - a. Explain the steps to construct TTT diagram. Draw a labeled sketch of TTT diagram for an eutectoid steel. (10 Marks)
 - b. Explain the following : i) Annealing ii) Normalizing. (10 Marks)
- 6
 - a. Explain the following : i) Pack carburizing ii) Flame hardening. (10 Marks)
 - b. Briefly explain Microstructure of Grey Cast Iron and SG Iron. Mention the composition, properties and applications of each. (10 Marks)
- 7
 - a. Explain the process of preparation of MMC using Melting and Casting method (Stir Casting method). (10 Marks)
 - b. Explain the following with neat sketches :
i) Hand layup process ii) Spray process. (10 Marks)
- 8
 - a. Explain with a neat sketch, the Sheet – Moulding Compound (SMC) process of producing composites. (08 Marks)
 - b. What are the Applications of Composites? (04 Marks)
 - c. Calculate the tensile modulus of elasticity of unidirectional Carbon – fiber reinforced Composite Material which contains 62% by volume of carbon fibers in Iso – strain and Iso – stress condition.
 $E_{\text{carbon fibers}} = 3.86 \times 10^4 \text{ kg/mm}^2$ and $E_{\text{epoxy}} = 4.28 \times 10^2 \text{ kg/mm}^2$. (08 Marks)
- 9
 - a. Make use of different processing methods for the manufacturing of thermoplastics and explain the following : i) Hydrostatic extrusion ii) Slip casting. (10 Marks)
 - b. Explain the following with neat sketches : i) Calendering ii) Blow moulding. (10 Marks)
- 10
 - a. Write a note on Piezoelectric materials. (06 Marks)
 - b. List and explain the Biological applications of smart materials. (06 Marks)
 - c. Explain briefly few common NDT methods used for the testing of materials. (08 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.