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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)

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