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Third Semester B.E. Degree Examination, Feb./Mar. 2022

Material Science and Metallurgy

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 and show that APF of FCC crystal structure is higher than that of BCC crystal structure. (10 Marks)
b. State and explain Fick's First law of diffusion. (06 Marks)
c. List the mechanisms of diffusion in solids and explain any two with neat sketches. (04 Marks)

OR

- 2 a. Draw the stress-strain diagram for a mild steel material. Explain how the following properties are determined with the help of stress-strain diagram:
(i) Ductility
(ii) Yield strength
(iii) UTS (10 Marks)
b. Explain plastic deformation of single crystal by slip and twinning with neat sketches. (06 Marks)
c. Define True Stress and True Strain. (04 Marks)

Module-2

- 3 a. Define fracture. Explain Cup and Cone fracture with a neat diagram. (08 Marks)
b. Define Creep. With a typical creep curve, explain the different stages of creep. (08 Marks)
c. Explain creep properties. (04 Marks)

OR

- 4 a. Define fatigue. Explain with a neat sketch, RR Moore Bending fatigue test and S-N curve. (10 Marks)
b. Explain the different types of fatigue loading with examples. (06 Marks)
c. Explain fatigue properties. (04 Marks)

Module-3

- 5 a. Define Homogeneous and Heterogeneous nucleation. Explain in brief. (08 Marks)
b. Explain different types of solid solutions with suitable sketches. (06 Marks)
c. State and explain Hume-Rothery's rule for the formation of substitutional solid solutions. (06 Marks)

OR

- 6 a. Describe the construction of phase diagram by a thermal analysis method. (08 Marks)
b. State Gibb's phase rule. Define the terms phases component and degree of freedom. (06 Marks)
c. Draw peritectic phase diagram and write the peritectic reaction. (06 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.

Module-4

- 7 a. Draw the TTT diagram for eutectoid steel and explain different microstructures. (08 Marks)
b. Define hardenability. Explain Jominy End Quench test of measuring hardenability. (06 Marks)
c. Explain flame hardening and induction hardening process with suitable sketches. (06 Marks)

OR

- 8 a. Explain properties, composition and uses of Grey Cast Iron, S.G. Iron and Steel. (10 Marks)
b. Write short note on age hardening of (i) Copper alloys (ii) Aluminium alloys (10 Marks)

Module-5

- 9 a. Define composite materials. Describe the role of matrix and reinforcement in composite materials. (08 Marks)
b. Explain pultrusion process for the production of FRP's with a neat sketch. (06 Marks)
c. What are the advantages and applications of composite materials? (06 Marks)

OR

- 10 a. Write short notes on:
(i) Brasses and Bronzes
(ii) Al-Cu and Al-Si (10 Marks)
b. List the advantages, disadvantages and applications of non ferrous metals. (10 Marks)
