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10ME32A

Third Semester B.E. Degree Examination, June 2012

Material Science and Metallurgy

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- 1 a. Explain the terms:
 - i) Space lattice
 - ii) Coordination number
 - iii) Atomic packing factor (06 Marks)
- b. Clearly explain different mechanisms of diffusion in solids. (06 Marks)
- c. With neat sketches, explain vacancy and Schottky imperfection. Calculate the equilibrium number of vacancies per cubic meter for copper at 1000°C. The energy for vacancy formation is 0.9 eV/atom. The atomic weight and density (at 1000°C) for copper are 63.5 g/mol and 8.4 g/cm³ respectively. (Boltzman's constant = 8.62×10^{-5} eV/K) (08 Marks)

- 2 a. Draw stress-strain diagram for a ductile material and explain the salient points. (09 Marks)
- b. What do you mean by true stress and true strain? A cylindrical specimen of steel having an original diameter of 12.8 mm is tensile tested to fracture and found to have an engineering fracture strength σ_f of 460 MPa. If its cross sectional diameter at fracture is 10.7 mm, determine:
 - i) The ductility in terms of percent area reduction.
 - ii) The true stress at fracture. (06 Marks)
- c. Differentiate between slip and twinning. (05 Marks)

- 3 a. Explain with sketches the ductile and brittle fracture in materials. (07 Marks)
- b. Explain the following:
 - i) S-N diagram
 - ii) Fatigue properties (06 Marks)
- c. Define creep. With the help of a neat diagram, explain the three stages of creep. (07 Marks)

- 4 a. Define nucleation. Distinguish between homogeneous and heterogeneous nucleation. (07 Marks)
- b. What are solid solutions? Explain the factors governing the formation of substitution solid solution. (07 Marks)
- c. State and explain Gibb's phase rule. How it can be applied to a unary phase diagram? Show that degrees of freedom at a triple point is zero. (06 Marks)

PART – B

- 5 a. Draw iron carbon equilibrium diagram and label all phase fields, temperatures and compositions on it. Discuss the different invariant reactions and draw the microstructure of 0.6% C steel at room temperature. (14 Marks)
- b. What is a phase diagram? Clearly explain the different predictions that can be made from phase diagram. (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.

- 6** a. Explain the construction of TTT diagram. **(10 Marks)**
b. With a neat sketch explain the following heat treatment processes on steel:
i) Annealing
ii) Normalizing **(10 Marks)**
- 7** a. Write composition, properties and uses of:
i) S.G iron
ii) Malleable cast iron
iii) Grey cast iron **(12 Marks)**
b. Write short notes on:
i) Cupro nickel
ii) Bronzes **(08 Marks)**
- 8** a. What is a composite material? Discuss the role of matrix and reinforcement in a composite material. **(06 Marks)**
b. Compare MMCs with PMCs. **(06 Marks)**
c. Write a short note on FRPs. **(08 Marks)**

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