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Fourth Semester B.E. Degree Examination, June/July 2013
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. With neat sketch, explain body centered cubic face centered cubic and closed packed hexagonal structures with examples. (09 Marks)
 - b. Derive expression for atomic packing factor of BCC, FCC and HCP structure. (07 Marks)
 - c. Briefly explain the different types of point defects. (04 Marks)
 - 2 a. With the help of stress-strain diagram, explain the behaviour of ductile and brittle materials. (08 Marks)
 - b. The following data have been obtained in hardness test of specimens. Calculate the hardness number. Assume dia of ball indenter = 10mm. (06 Marks)
- | Material | Type | Load (kgf) | Impression (mm) |
|----------|----------|------------|-----------------|
| A | Brinell | 500 | 4.6 |
| B | Vicker's | 5 | 0.28 |
- c. Define the following terms Toughness, Resilience, Proof stress and ductility. (06 Marks)
 - 3 a. With neat diagram, explain the fracture in the following: i) Ductile; ii) Brittle; iii) Fatigue. (12 Marks)
 - b. Explain the three stages of creep with a neat sketch and its characteristics. (08 Marks)
 - 4 a. With neat diagram, explain the process of nucleation. (05 Marks)
 - b. Write a note on Gibb's phase rule with an example. (04 Marks)
 - c. With the help of cooling curve, explain how solidification process begins in pure metals. (06 Marks)
 - d. Briefly explain the rules behind the solid solubility. (05 Marks)

PART – B

- 5 a. Construct the Ag-Cu phase diagram using following data:
 Melting point of Ag = 960.5°C
 Melting point of Cu = 1085°C
 Eutectic point = 779.4°C
 Eutectic composition = 28.1% Cu
 Maximum solubility of Ag in Cu and Cu in Ag is 8%.
 Maximum solubility of Cu in Ag and Ag in Cu is 2%.
 Assume the liquidus, solidus and solvus lines are straight. Calculate:
 i) Amount of eutectic in 20% Cu, 80% Ag alloy at 700°C and
 ii) Percentages and compositions of solid phases in 60% Cu and 40% Ag alloy at 400°C. (10 Marks)
- b. What is level rule? Explain how it is useful. (05 Marks)
- c. What are phase diagrams? How are they classified? (05 Marks)

- 6 a. Draw Iron-Carbon equilibrium diagram and explain primary crystallization of steel hypoeutectic cast iron and hypereutectic cast iron. (10 Marks)
- b. Define the following annealing, normalizing, tempering, carburizing and nitriding. (10 Marks)
- 7 a. How cast iron are classified? What are the properties of cast iron? (08 Marks)
- b. How generally steels are classified? Consider at least two composition mixtures, mention its application and advantages. (08 Marks)
- c. Explain the composition, properties and uses of at least two copper based alloys. (04 Marks)
- 8 a. Derive an expression for load distribution in a composite for longitudinal loading of fiber reinforced composite. (10 Marks)
- b. With a neat diagram, explain the hand laminating process. (10 Marks)

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