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Fourth Semester B.E. Degree Examination, December 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. Define atomic packing factor. Calculate the atomic packing factor for BCC. (06 Marks)
b. What is diffusion? Explain. Give the Fick's laws of diffusion and their conditions. (08 Marks)
c. Iron has an atomic radius of 0.124 nm, B.C.C. crystal structure and an atomic weight of 55.85 g/mol. Calculate the density. (06 Marks)
- 2 a. Define the following terms:
i) Proportional limit ii) Hardness iii) Resilience iv) Toughness (08 Marks)
b. Explain Brinell hardness and Rockwell hardness with sketch and equations. (06 Marks)
c. Explain how yield strength is determined for a material which does not exhibit a distinct yield point. (06 Marks)
- 3 a. Draw S-N diagram for steel and aluminium alloy and explain the salient features. (06 Marks)
b. Sketch creep curve and explain different stages of creep. (06 Marks)
c. Explain fatigue failures and give the methods of reducing fatigue failure. (08 Marks)
- 4 a. Explain the mechanism of solidification and homogeneous and heterogeneous nucleation. (06 Marks)
b. State and explain Hume-Rothery's rules for solid solution. (05 Marks)
c. Differentiate between interstitial and substitutional solid solutions. (04 Marks)
d. State and explain with example the Gibb's phase rule. (05 Marks)

PART – B

- 5 a. Draw neatly Iron-carbon diagram and label all the parts. (08 Marks)
b. With the help of above diagram, explain cooling of steel with 0.9% carbon showing the micro-structure at different stages. (06 Marks)
c. Draw TTT diagram for eutectoid steel and explain the microstructures obtained at various cooling rates. (06 Marks)
- 6 a. What is heat treatment? Classify the various types of heat treatments. (08 Marks)
b. What is meant by carburizing of steels? Explain various types of carburizing. (08 Marks)
c. Differentiate between annealing and normalizing. (04 Marks)
- 7 a. Explain different types of cast irons with microstructure. (08 Marks)
b. Discuss the composition and uses of α -brasses and bronzes. (06 Marks)
c. Write short note on Aluminium alloys. (06 Marks)
- 8 a. Differentiate between a composite and alloy. (02 Marks)
b. Classify the composites based on reinforcement and matrix materials. (06 Marks)
c. Explain with sketches any two methods of production of FRP's. (06 Marks)
d. Explain with sketches any two methods of production of MMC's. (06 Marks)