

--	--	--	--	--	--	--	--	--	--

Third Semester B.E. Degree Examination, December 2011
Materials Science and Metallurgy

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART – A

- 1
 - a. Define unit cell, coordination number, vacancy and grain boundary. (04 Marks)
 - b. Draw a neat sketch of a BCC unit cell. Derive the relation between lattice parameters and atomic radius for the BCC unit cell. Calculate its atomic packing factor. (08 Marks)
 - c. Explain edge dislocation, with the help of a neat sketch. (04 Marks)
 - d. Explain briefly the vacancy mechanism of diffusion. (04 Marks)

- 2
 - a. Define engineering stress and true stress. Derive the relation between the two. (06 Marks)
 - b. A tensile specimen of 10mm diameter and 100mm gauge length is subjected to a tensile test. If its diameter is reduced to 8mm by applying a load of 1500N, what is its final length? Also determine engineering stress, engineering strain, true stress and true strain. (06 Marks)
 - c. Explain Vickers hardness testing, in brief. (04 Marks)
 - d. When a 3000 kg load is applied through a 10mm diameter ball in a Brinell test on steel, an indentation of 3.1mm is produced. Determine the BHN of the metal. (04 Marks)

- 3
 - a. Sketch the basic modes of fracture. List the differences between them. (06 Marks)
 - b. Explain with the help of a sketch, the fatigue behaviour of metals. State any three methods to improve fatigue resistance. (07 Marks)
 - c. With the help of a neat sketch, explain the different stages in a creep curve. Give two examples for creep resistant materials. (07 Marks)

- 4
 - a. State Hume – Rothery rules that govern the formation of solid solutions. (04 Marks)
 - b. Draw neatly labeled sketches of eutectic phase diagrams for a binary system with i) no solid solubility and ii) partial solid solubility. (06 Marks)
 - c. Describe the phase rule and lever rule in brief. (04 Marks)
 - d. A binary alloy system contains two solid phases α and β at a particular temperature. The compositions of α and β are A – 5% B and A – 95% B respectively. Calculate the amount of α and β in i) A – 40% B alloy and ii) A – 70% B alloy at that temperature. (06 Marks)

PART – B

- 5
 - a. Draw a neat labeled iron – carbon phase diagram. Write the three invariant reactions taking place in the system. (10 Marks)
 - b. Draw the schematic microstructures of slowly cooled eutectoid steel and hypo – eutectoid steel. (04 Marks)
 - c. Briefly explain the TTT diagram for eutectoid steel. (06 Marks)

- 6
 - a. Compare annealing and normalizing heat treatments adopted for steels. (06 Marks)

- b. Explain carburizing and flame hardening, in brief. (06 Marks)
 - c. Define hardenability. Explain with a neat sketch, the Jominy end quench test of determining the hardenability of steels. (08 Marks)
- 7**
- a. Briefly describe the composition, properties and applications of medium and high carbon steels. (10 Marks)
 - b. State the properties and applications of gray cast iron. (04 Marks)
 - c. Write a note on brasses. (06 Marks)
- 8**
- a. Define corrosion. State its effects. (03 Marks)
 - b. Briefly explain the mechanism of corrosion. (05 Marks)
 - c. Write a note on passivity. (04 Marks)
 - d. List various methods of corrosion prevention. Explain cathodic protection with examples. (08 Marks)
