USN | | | | | | | | | | |

06ME32A

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)**

*****