



**Third Semester B.E. Degree Examination, December 2010**  
**Materials Science and Metallurgy**

Time: 3 hrs.

Max. Marks:100

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

**PART - A**

- 1 a. Define : i) Space lattice ; ii) Unit cell ; iii) Atomic packing factor. (06 Marks)
- b. Classify crystal imperfections. Explain the point defects, in detail. (06 Marks)
- c. Calculate the packing efficiency of a BCC structure. (03 Marks)
- d. Define diffusion. What are the factors affecting diffusion? (05 Marks)
- 2 a. With the help of a neat conventional stress – strain diagram, explain the behavior of mild steel, under static uniaxial, tension, till fracture. (06 Marks)
- b. With a neat sketch, explain the plastic deformation of a single crystal, by slip. (06 Marks)
- c. A copper wire has a nominal breaking strength of 300 MPa. Its ductility is 77% reduction of area. Calculate the true stress for fracture. (04 Marks)
- d. Differentiate between : i) Toughness and resilience ; ii) Ductility and brittleness. (04 Marks)
- 3 a. Define creep. With a typical creep curve, explain the different stages of creep. (06 Marks)
- b. What are the various factors affecting fatigue strength? Explain. (06 Marks)
- c. Draw the S – N diagrams for mild steel and aluminium and explain. (04 Marks)
- d. Write note on ductile fracture. (04 Marks)
- 4 a. Explain with neat sketches the substitutional and interstitial solid solutions, with examples. (05 Marks)
- b. With reference to cooling curves for a binary solid solution, explain the Gibb's phase rule. (04 Marks)
- c. What are invariant reactions? With neat sketches, explain :  
i) Eutectic reaction and ii) Eutectoid reaction. (05 Marks)
- d. Melting point of lead is 327°C and that of tin is 232°C. They form an eutectic of 62% tin at 183°C. At this temperature, the maximum solid solubility of tin in lead is 19% and that of lead in tin is 3%. Assuming liquidus and solidus lines to be straight, draw the phase diagram and label all the regions. Also find the freezing range for the 30% tin and 70% lead alloy. (06 Marks)

**PART - B**

- 5 a. Draw a neat sketch of iron – iron carbide equilibrium diagram and mark on it all salient temperatures, compositions and phases. Describe the mode of solidification and room temperature microstructure of a very slowly cooled steel of carbon content 1.2%. (10 Marks)
- b. What is TTT diagram? Explain with a neat diagram the martensitic transformation of austenite. (10 Marks)
- 6 Write notes on the following heat treatment processes : a. Annealing ; b. Tempering ; c. Carburizing ; d. Precipitation hardening. (20 Marks)
- 7 a. What is meant by S.G. iron? Explain the structure, composition and properties of SG iron. (06 Marks)
- b. Give the compositions and applications of magnesium based alloys. (06 Marks)
- c. Write a note on aluminium alloys. (08 Marks)
- 8 a. Define corrosion in metals. Explain general methods of corrosion control and its prevention. (10 Marks)
- b. What is electrode potential? What is its significance? (04 Marks)
- c. With a neat sketch, explain the galvanic cell. (06 Marks)

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