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10ME32A/AU32A/MT32

**Third Semester B.E. Degree Examination, Dec.2015/Jan.2016**

**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 the terms space lattice, unit cell and APF. (06 Marks)
- b. Cr has an atomic radius of 0.125nm, a BCC crystal structure and an atomic weight of 52g/mol. Calculate its density. (Avogadro number is  $6.023 \times 10^{23}$ ) (06 Marks)
- c. Differentiate between edge and screw dislocation with neat sketches. (08 Marks)
- 2 a. Draw the stress – strain diagram of Aluminium and explain the following properties  
i) Proof stress ii) Toughness (05 Marks)
- b. A 10mm aluminium alloy rod is subjected to a 6kN tensile load. If the diameter of the rod is 9mm at this load determine the engineering stress, engineering strain, true stress and true strain. (08 Marks)
- c. Distinguish between slip and twinning with neat sketches. (07 Marks)
- 3 a. Define the following terms with sketches  
i) Fatigue limit ii) Fatigue strength iii) Fatigue life. (06 Marks)
- b. Explain the different stages of creep with a neat sketch of the creep curve. (08 Marks)
- c. Compare ductile and brittle fracture with neat sketches. (06 Marks)
- 4 a. What is a solid solution? Explain the Hume-Rothery rules for the formation of substitutional solid solution with examples. (08 Marks)
- b. Compare homogeneous and heterogeneous nucleation with sketches. (06 Marks)
- c. Write short notes on intermediate phases. (06 Marks)

**PART – B**

- 5 a. Give the three invariant reactions of the Fe – C system indicating the temperature and composition. (06 Marks)
- b. Explain the solidification of hypoeutectoid steel containing 0.3%C indicating the micro structures at different stages with a neat sketch. (08 Marks)
- c. Construct a phase diagram for two metals completely soluble in the liquid state but partially soluble in the solid state. Give any two examples. (06 Marks)
- 6 a. Draw the CCC diagram and explain briefly for a plain carbon eutectoid steel. (07 Marks)
- b. Explain age hardening of Al-Cu alloy with a sketch. (08 Marks)
- c. Distinguish between process annealing and spheroidising with a sketch. (05 Marks)
- 7 a. Compare SG iron, Grey cast Iron and white cast Iron with respect to composition, microstructure, properties and applications. (12 Marks)
- b. Write short notes on the following.  
i) Al – Si alloys ii) Brasses (08 Marks)
- 8 a. Define a composite. What is the role of matrix in a composite material? (06 Marks)
- b. Explain with a neat sketch the pultrusion process or hand layup process. (08 Marks)
- c. Give three commonly used matrix materials and reinforcement fibers used in the production of FRP'S. (06 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written e.g. 42+8 = 50, will be treated as malpractice.