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10ME/AU42A

**Fourth Semester B.E. Degree Examination, June/July 2014**  
**Material 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. Explain crystal imperfections with a neat sketch. (06 Marks)
  - b. Define diffusion. What are the factors affecting diffusion? (08 Marks)
  - c. Copper has F.C.C. structure and an atomic radius of  $1.278 \text{ \AA}$ . Calculate its density. Given mol. wt = 63.54 g/mole. (06 Marks)
- 2
  - a. Define the following:
    - i) Toughness; ii) Yield stress; iii) Proportional limit; iv) Resilience. (08 Marks)
  - b. Derive an expression for critically resolved shear stress in a crystal structure. (08 Marks)
  - c. Calculate the resolved shear stress of a limit cell in a nickel if a tensile stress of 13.7 MPa is applied. Given that angle between the axial force and slip direction is  $45^\circ$  and angle between axial force and normal to slip plane is  $54^\circ$ . (04 Marks)
- 3
  - a. Derive an expression for homogeneous nucleation with a suitable graph. (10 Marks)
  - b. Explain the following with a suitable sketches:
    - i) Substitutional solid solution. (10 Marks)
    - ii) Interstitial solid solution. (10 Marks)
- 4
  - a. What are the factors affecting the fatigue life? (06 Marks)
  - b. Write a short note on the following: i) Ductile fracture; ii) Brittle fracture. (08 Marks)
  - c. Draw a creep curve and explain its various stages. (06 Marks)

**PART – B**

- 5
  - a. Explain the classification of cast irons in detail. (10 Marks)
  - b. Why is iron carbide diagram drawn until 6.67% carbon? (06 Marks)
  - c. Define Martensite, Cementite, Austenite and Ferrite. (04 Marks)
- 6
  - a. What are the objectives of heat treatment? (06 Marks)
  - b. Explain with a neat sketch of Jominy end quench test method. (08 Marks)
  - c. Explain inductive hardening with a neat sketch. (06 Marks)
- 7
  - a. What is merit by S.G. iron? Explain the structure composition and properties of S.G. iron. (06 Marks)
  - b. What are the factors affecting microstructure of cast iron? Explain. (08 Marks)
  - c. Explain the classification of engineering materials. (06 Marks)
- 8
  - a. Explain the classification of composite materials. (08 Marks)
  - b. What do you mean by ceramic matrix composites? (06 Marks)
  - c. List the advantages and disadvantages of composite materials. (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 eg, 42+8 = 50, will be treated as malpractice.