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10ME32A/AU32A/TL32/MT32

Third Semester B.E. Degree Examination, June/July 2013

Materials 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. Explain: i) APF, ii) Coordination number. Show that atomic packing factor of FCC crystal structure is higher than that of BCC crystal structure. **(10 Marks)**

b. Discuss the principal types of point defects found in crystals. Explain their significance. **(06 Marks)**

c. How do you distinguish between steady state and non-steady state diffusion? **(04 Marks)**

2 a. Explain in detail the mechanical properties in elastic and plastic region. **(10 Marks)**

b. Discuss how the slip phenomenon differs in case of a polycrystal to the single crystal. **(06 Marks)**

c. Distinguish between slip and twinning. **(04 Marks)**

3 a. How fractures are classified? State and explain different types of fracture giving appearance of the fracture in each case. **(10 Marks)**

b. What is meant by creep? With the help of creep curve, explain different stages of creep. **(06 Marks)**

c. Write a brief note fatigue properties. **(04 Marks)**

4 a. Define nucleation. Derive an expression for the critical size of the nucleus for homogeneous nucleation. **(08 Marks)**

b. Describe the solidification mechanism in a pure metal. Distinguish between homogeneous and heterogeneous nucleation. **(06 Marks)**

c. Discuss the factors worked out by Hume-Rothery that governs the formation of an ideal solid solution. **(06 Marks)**

PART – B

5 a. Draw iron-carbon equilibrium diagram and mark on it all salient temperatures, composition and phases involved. Elaborate the invariant reactions. **(10 Marks)**

b. State Gibb's phase rule and explain the terms associated with it. **(06 Marks)**

c. Explain the lever rule with an example. **(04 Marks)**

6 a. What is the purpose of case hardening? Discuss the different methods of case hardening. **(10 Marks)**

b. What is T-T-T diagram? How is it different from phase diagram? Describe the various transformed products of austenite on cooling. **(06 Marks)**

c. How do you distinguish normalizing, full annealing and process annealing? **(04 Marks)**

7 a. State the properties and uses of grey cast iron, malleable cast iron, spheroidal cast iron and white cast ion. **(10 Marks)**

b. Distinguish between the following:

i) Hypo-eutectoid and hyper-eutectoid steels

ii) Hypo-eutectic and hyper-eutectic cast irons. **(06 Marks)**

c. Write a note on Al-Si alloys. **(04 Marks)**

8 a. Define composite material and give the classification of composites. Enumerate important characteristics of composites. **(08 Marks)**

b. Describe the features of fibrous composites, laminated composites and particulate composites. **(08 Marks)**

c. Explain the role of reinforcement and matrix materials in a composite. **(04 Marks)**

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