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10ME42A/10AU42A

**Fourth Semester B.E. Degree Examination, June/July 2015**  
**Material Science and Metallurgy**

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting atleast TWO questions from each part.**  
**2. Use of Handbook / Charts / Tables etc are not required.**

**PART - A**

- 1 a. What do you mean by co-ordination number? With a neat figure, write co-ordinations number for HCP structures. (04 Marks)
- b. What is Crystal Imperfections? With a neat sketches, explain line defects and surface defects. (12 Marks)
- c. Explain briefly, Factors affecting diffusion. (04 Marks)
- 2 a. Differentiate between i) Engg. Stress of True stress ii) Engg. Strain and True strain. Derive the relation between Engg. Strain and True Strain. (08 Marks)
- b. Explain with neat sketches, plastic deformation by i) Slip and ii) Twinning. (08 Marks)
- c. Draw the stress – strain curve for a ductile material and explain the important points on the curve. (04 Marks)
- 3 a. What do you mean by Type – I, Type – II, and Type – III fractures? Explain with neat sketches. (06 Marks)
- b. What is Creep? Explain creep curve, with neat sketch. (08 Marks)
- c. Explain with neat sketches, Typical fatigue stress cycles (Fatigue Loading). (06 Marks)
- 4 a. Explain with neat sketch, the mechanism of solidification. (05 Marks)
- b. What is Homogeneous Nucleation? With a neat sketch, derive the relation for free energy charge,  $\Delta f_e$ . (10 Marks)
- c. Explain Hume – Rothary Rules for formation of solid solutions. (05 Marks)

**PART - B**

- 5 a. Explain briefly the construction of phase diagram using cooling curve, with a neat sketch. (05 Marks)
- b. Name the different types of phase diagrams. Explain with a neat sketch solid solution phase diagram (Complete solubility). (10 Marks)
- c. Draw the Iron - Carbon Equilibrium diagram and label all the phases. (05 Marks)
- 6 a. What do you mean by T - T - T curves? Explain with neat sketches, the construction of TTT curves for plain carbon steel. (10 Marks)
- b. Explain with neat sketch, Pack carburizing. (05 Marks)
- c. Explain with neat sketch, Flame Hardening. (05 Marks)
- 7 a. Explain the Composition, Properties and Applications of i) Gray cast iron ii) Malleable cast iron. (10 Marks)
- b. Explain the Composition, Properties and Application of i) Aluminum - Copper Alloys ii) Aluminum - Zinc Alloys. (10 Marks)
- 8 a. Define the Composite material. Explain the different types of Matrix Materials and Types of Reinforcements. (10 Marks)
- b. Explain with a neat sketch, the 'Pultrusion' process for producing FRP's. (06 Marks)
- c. Give the Advantages and Applications of composites. (04 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 for equations written eg. 42+8 = 50, will be treated as malpractice.