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10ME/AU32A

**Third Semester B.E. Degree Examination, June/July 2017**  
**Material Science & Metallurgy**

Time: 3 hrs.

Max. Marks:100

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

**PART – A**

- 1 a. Draw the unit cell of BCC and FCC and find the coordination number and atomic packing factor for both. (08 Marks)
- b. With neat figures, explain the line defects in crystal imperfections. (08 Marks)
- c. State and explain the Fick's first law of diffusion. (04 Marks)
- 2 a. Explain the meaning of resilience, modulus of resilience, ductility and toughness. (08 Marks)
- b. Explain the mechanism of plastic deformation of single crystal by slip and twinning, with the help of neat sketches. (08 Marks)
- c. Draw stress-strain diagrams showing ductile and brittle behavior of materials. (04 Marks)
- 3 a. Briefly explain the creep properties and stress relaxation. (08 Marks)
- b. With neat sketches, explain the stages of fatigue failure. (08 Marks)
- c. What is fracture? How are they classified? (04 Marks)
- 4 a. Explain briefly the process of homogeneous and heterogeneous nucleation. (08 Marks)
- b. Explain the differences between substitutional and interstitial solid solutions. (08 Marks)
- c. Write briefly about Gibb's phase rule and modified phase rule. (04 Marks)

**PART – B**

- 5 a. With neat sketches, explain the construction of phase diagram. (08 Marks)
- b. Draw a neat sketch of  $F_c - F_{c3}C$  equilibrium diagram. Label all the fields and on that demarcate the regions where the following reactions take place: (i) Eutectic (ii) Peritectic and (iii) Eutectoid. (08 Marks)
- c. State and discuss lever rule with an example. (04 Marks)
- 6 a. Superimpose continuous cooling curves on TTT diagram and describe the various transformed products of austenite on cooling. (08 Marks)
- b. With sketches, explain Austempering and Martempering. (06 Marks)
- c. With a neat sketch, explain the process of induction hardening. (06 Marks)
- 7 a. Write the typical composition, important properties and general application of low carbon steel and high carbon steel. (08 Marks)
- b. Write briefly about Brasses and Bronzes. (06 Marks)
- c. Write composition, properties and uses of Al-Cu and Al-Si alloys. (06 Marks)
- 8 a. With a neat sketch, explain the production of MMC by sand casting technique. (08 Marks)
- b. What is composite material? Write the classifications of composite materials. (06 Marks)
- c. What are the advantages and applications of composites? (06 Marks)

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