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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Fourth Semester

(Regulation 2004)

Mechanical Engineering

MH 1151 — ENGINEERING MATERIALS AND METALLURGY

(Common to Automobile Engineering, Production Engineering)

(Common to B.E. (Part-Time) Third Semester Regulation 2005)

Time : Three hours

Maximum : 100 marks

Draw sketches wherever necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are limitations of equilibrium diagram?
2. Why is gray cast iron used for machine beds?
3. What is purpose of deep freezing in the heat treatment of steels?
4. What is bright hardening?
5. State any two distinguishing characteristics of nickel maraging steels.
6. What are the two primary methods of strengthening aluminium?
7. What is the difference in molecular structure between thermoset and thermoplastic polymers?
8. Name two industrial items made from carbon-graphite.
9. State any two differences between elastic and plastic deformations.
10. A metal has a hardness of 30 HRC. What is its Brinell hardness?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss the conditions favourable for a solid solution. (6)
- (ii) Bismuth and cadmium having melting points respectively 270°C and 320°C are assumed to be completely soluble in liquid state and completely insoluble in solid state. They form eutectic at 140°C, containing Cadmium 40%. Draw the equilibrium diagram and label all regions and lines. Calculate the relative amount of phases present in the eutectic alloy at room temperature. (10)

Or

- (b) Draw Fe-Fe₃C diagram and explain the invariant points. Also calculate the relative amount of phases present at room temperature for 0.3% C steel. (16)
12. (a) (i) Explain austempering, martempering and hardening with the help of TTT diagram for an eutectoid steel. (12)
- (ii) State the applications and limitations of induction hardening. (4)

Or

- (b) (i) How will the microstructure differ in three samples of a 0.40% carbon steel after the following heat treatments :
- (1) Heated to 1420°C and air-cooled.
 - (2) Heated to 1420°C and oil quenched.
 - (3) Heated to 1420°C and water quenched. (12)
- (ii) What are the advantages of gas carburizing compared with pack carburizing? (4)
13. (a) (i) Explain with suitable examples how alloying elements that dissolve in ferrite increase its strength. (6)
- (ii) Differentiate, in microstructure and properties, gray cast iron and ductile iron. (10)

Or

- (b) (i) Discuss the effect on corrosion resistance of copper by increasing additions of Zinc, Tin and Nickel. (9)
- (ii) Compare the lead-base and tin-base babitts with regard to properties and applications. (7)

14. (a) Describe the molecular structure, properties and applications of the following polymers : (16)
- (i) Polystyrene
 - (ii) Polyethylene terephthalate
 - (iii) Polyphenylene Sulfide and
 - (iv) Polytetrafluoroethylene.

Or

- (b) Discuss the properties and applications of the following :
- (i) Silicon Carbide and Partially Stabilized Zirconia. (8)
 - (ii) Fiber reinforced and particulate reinforced composites. (8)
15. (a) (i) How may one distinguish between slip and twinning if the width of the twin band is of the same order as a slip line? Explain. (6)
- (ii) With the help of a neat sketch explain the Charpy impact testing procedure and why impact specimens are notched. (10)

Or

- (b) (i) Discuss the characteristics of ductile and brittle fracture. (8)
- (ii) Explain with the help of a neat sketch the procedure for fatigue. (8)