

C 3316

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fourth Semester

(Regulation 2004)

MH 1151 — ENGINEERING MATERIALS AND METALLURGY

(Common to Automobile Engineering/Mechanical Engineering/Production Engineering)

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

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between hypo-eutectoid steels and hyper-eutectoid steels.
2. Define peritectoid reaction.
3. What is the principle of surface hardening in induction hardening process?
4. What is the need for providing a tempering treatment after quench hardening of steels?
5. Distinguish between gray cast irons and spheroidal graphite cast irons in terms of microstructures and mechanical properties.
6. What is the composition of 18/4/1 type high speed steel?
7. Write the molecular structure of either phenol-formaldehyde (PF) polymer or urea-formaldehyde (UF) polymer.
8. Give two examples of particulate reinforced metal matrix composites.
9. Distinguish between slip and twinning.
10. How will you express the deformation characteristics of a material through tension test?

PART B — (5 × 16 = 80 marks)

11. (a) Two elements A and B have melting points 800°C and 600°C respectively.
- (i) Draw a phase diagram between A and B if they exhibit unlimited solid solubility. (6)
 - (ii) Draw a phase diagram between A and B if a eutectic reaction occurs at composition 40%B and at temperature 400°C. Assume that the maximum solid solubility in either case is 5% and the room temperature solubility in either case is 1%. (10)

Or

- (b) (i) Draw the iron-carbon equilibrium diagram. (10)
 - (ii) What will be the microstructure of a 0.25%C steel at room temperature? (6)
12. (a) (i) Explain the Jominy end quench test used for determining the hardenability of steels. (10)
- (ii) What are austempering and martempering treatments? What are their purposes? (6)

Or

- (b) Explain the following heat treatment processes used for steels in terms of temperature of heating, method of cooling and the structural transformation in the steel due to the heat treatment.
 - (i) Annealing.
 - (ii) Spheroidising
 - (iii) Normalising
 - (iv) Hardening. (4 × 4)
13. (a) (i) Using the Al-Cu alloy system as example, explain the concept of precipitation heat treatment. (10)
- (ii) Explain how a malleabilising heat treatment will convert a white cast iron to a malleable cast iron. (6)

Or

(b) Write short notes about the following materials in terms of composition, properties and applications.

(i) Maraging steels

(ii) Alpha-beta brasses

(iii) Austenitic stainless steels

(iv) Ferritic stainless steels.

(4 × 4)

14. (a) Explain the following polymers with respect to their molecular structures, properties and applications.

(i) Polypropylene

(ii) Polyvinyl chloride

(iii) Polytetra Fluoroethylene

(iv) Polyethylene Terephthalate.

(4 × 4)

Or

(b) (i) Write a short note about the different types of matrix materials and reinforcement materials used to make polymer matrix composites.

(10)

(ii) Discuss the properties and applications of Al_2O_3 and SiC ceramics.

(6)

15. (a) (i) Explain the testing procedure for charpy impact testing of materials.

(10)

(ii) Write a short note about different types of metallic fractures.

(6)

Or

(b) Explain the testing procedures for determining the following properties :

(i) Brinell Hardness Number

(ii) Creep strength.

(8 + 8)