D 4524

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

Annual Pattern – First Year

Mechatronics Engineering

MH 1 X 01 — ENGINEERING MATERIALS AND METALLURGY

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Calculate the atomic packing factor for FCC structures.

2. Define pearlite in iron–carbon alloy system.

3. What is austempering heat treatment?

4. A carbon steel containing 0.8% carbon is not suitable for case carburising. Why?

5. What is the strengthening mechanism in maraging steel?

6. Distinguish between alpha brass and alpha-beta brass in terms of composition and properties.

7. What are the applications of Al_2O_3 and SiC ceramics?

8. Name four polymers under the ethenic group of polymers.

9. Draw a sketch of standard specimen used for Izod impact testing.

10. Name any four thermal spray processes.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw the crystallographic directions [110] and [111] and the crystallographic planes (110) and (111) in cubic cells. (10)

(ii) Calculate the ASTM grain size number of a material if its microstructure shows 64 grains in a circle of 2 inch diameter at a magnification of 200 X. (6)

Or

(b) (i) Draw the iron carbon phase diagram. (10)

(ii) From the iron carbon diagram, estimate the percents of ferrite and pearlite for a 0.6% C steel. (6)

12. (a) (i) Draw an isothermal transformation diagram for a 0.8% C steel. In the same diagram draw cooling curves corresponding to annealing, normalising and hardening for that steels (no explanation is required). (10)

(ii) Discuss the heat treatment processes annealing, normalising and hardening for a hypo-eutectoid steel in terms of heat treatment temperature, method of cooling and the properties of the steel after heat treatment. (6)

Or

(b) (i) Explain the steps involved in case carburising of a steel. (10)

(ii) How are hardenability curves drawn using Jominy and Quench test? (6)

13. (a) What is the mechanism of strengthening of materials by precipitation treatment? Explain the different steps involved in precipitation treatment. (16)

Or

(b) Explain the terms overaging, natural aging and artificial aging. (16)

14. Explain the following polymers interms of molecular structure, properties and applications :

(a) (i) Polyethylene. (8)

(ii) Polypropylene. (8)

Or

(b) (i) Polytetrafluoro ethylene. (8)

(ii) Polycarbonate. (8)

5. (a) (i) Explain the testing procedure for Vickers hardness testing. (10)

(ii) Distinguish between brittle fracture and ductile fracture. (6)

Or

(b) Write short notes on :

(i) Diffusion coating

(ii) Electroplating. (8 + 8)
