C 58182 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2009

ME/AM 04 404—METALLURGY AND MATERIAL SCIENCE

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

I. 1 Distinguish between "ionic bond" and "metallic bond" in solids.

2 What do you understand by "Miller indices" ? Explain with the help of an example.

3 Distinguish between "slip" and "twinning" as modes of plastic deformation of metal and alloys.

4 Write short notes on the following :—

(a) Ductile and brittle fracture.

(b) Edge dislocation and screw dislocation.

5 Name the different annealing processes. Is spheroidising different from annealing ? Explain.

6 Discuss nitriding as a method of surface hardening of steel and compare it with induction-hardening.

7 What are the properties of pure aluminium ?

8 Explain in detail about "shape memory alloys".

(8 × 5 = 40 marks)

II. 1 (a) What are the different X-ray diffraction techniques and explain any *one* of them in detail. (8 marks)

(b) How the atomic packing factor is calculated for the following structure :—

(i) FCC structure. (ii) BCC structure.

(iii) HCP structure.

(7 marks)

Or

2 (a) Write a short notes on polymorphism and allotropy. (5 marks)

(b) Give the classification of engineering materials and discuss their properties. (10 marks)

III. 1 (a) Draw the S-N curves for steel and A1. Explain how these curve are experimentally developed.

(8 marks)

(b) Explain the possible point defects briefly. (7 marks)

Or

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2 (a) Explain in detail Frank-Read Source. (7 marks)

(b) Draw a typical "creep-test" curve, showing different stages of elongation for a long time high temperature creep test. State how the information is helpful to the designer. (8 marks)

IV. 1 (a) Describe briefly the different methods of case hardening of steel. (7 marks)

(b) Describe briefly the Austempering and Mantempering process. What are the special advantages of these heat treatment operations. (8 marks)

Or

2 (a) Explain Hume Rothary rules as applied to the formation of solid solution. (8 marks)

(b) Distinguish between substitutional and interstitial solid solution with examples. (7 marks)

V. 1 (a) Discuss the specific application of (i) white cast iron ; (ii) Grey cast iron ; (iii) S.G. Iron. (8 marks)

(b) In what ways can the mechanical properties of alloys be improved ? What is the affect of adding Cu to A1 ? (7 marks)

Or

2 (a) Discuss the effect of the alloying elements–chromium, Nickel and Molybdenum on the properties of steel. (7 marks)

(b) Give an account on manomaterials. (8 marks)

[4 × 15 = 60 marks]