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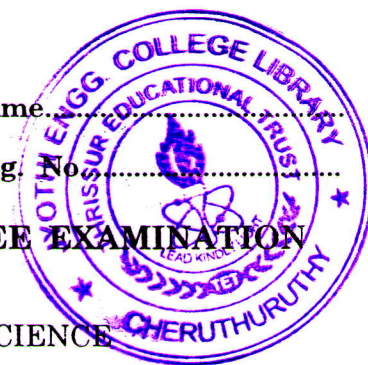
Name.....

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 Al. 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 Al ? (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]