B. Tech Degree IV Semester (Special Supplementary) Examination, March 2007

ME 402 METALLURGY AND MATERIAL SCIENCE

(1999 Admissions onwards)

Time : 3 Hours Maximum Marks : 100

I. (a) Calculate the interplanar distance of (2 0 0) plane and (1 1 1) plane of nickel (FCC). The radius of nickel atom is 1.245 A^0. (5)

(b) Define Atomic Packing Factor. Calculate the APF for an hcp structure. (5)

(c) With neat sketches explain the following:
(i) stacking faults (ii) twinning (10)

OR

II. (a) With a suitable graph explain how homogeneous, heterogeneous and dendritic structures are obtained when an alloy solidifies. (10)

(b) Compare interstitial and vacancy atomic mechanisms of diffusion. (5)

(c) Explain the various factors that influence diffusion. Cite three metallurgical applications of diffusion. (5)

III. (a) What do you understand by a solid solution? Explain substitutional solid solution and interstitial solid solution. Give an example for each. (8)

(b) Explain the Ag.pt phase diagram and explain the peritectic reaction from the diagram. (12)

OR

IV. (a) What are Hume-Rotheny empirical rules for the formation of solid solutions? Explain giving suitable examples. (8)

(b) Explain Fe-Fe_3C phase diagram giving the major reactions involved. What are the various microstructures that are produced in steel alloys? (12)

V. (a) Discuss pearlite transformation and bainite transformation with reference to TTT diagram. (10)

(b) Compare nitriding and carburising . Explain the procedure of nitriding along with its applications. (10)

OR

VI. (a) Distinguish between hardness and hardenability. How can hardness of steel be increased. List the factors affecting hardenability. (10)

(b) Explain the following processes:
(i) hot dipping (ii) metal cladding
(ii) impregnation (10)

VII. (a) What is the significance of dislocation in plastic deformation of metals. What is a burgers vector? (10)

(b) Explain the characteristics of brittle fracture and ductile fracture. Explain Griffith's Theory of fracture. (10)

OR

VIII. (a) Explain recovery recrystallisation and grain growth with suitable graph. (10)

(b) What is creep? Draw a typical creep curve and explain the different stages of creep. (10)

IX. (a) What are the functions of alloying elements of steel? Explain with suitable examples. (10)

(b) Explain the composition of the following alloys with their uses.
(i) Duralumin (ii) German silver
(iii) Gun metal (iv) Monel metal
(v) ICONOL (10)

OR

X. (a) Explain the composition properties and uses of:
(i) S.G. Iron (ii) White cast iron
(iii) Malleable iron (10)

(b) List the important alloys of aluminium with their composition properties and uses. (10)

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