

END-TERM EXAMINATION

FIFTH SEMESTER [B.TECH.]— DECEMBER-2007

Paper Code:ETME-305(Batch-2004-2005)

Subject: Material Science & Metallurgy

Paper ID:36305

Time : 3 Hours

Maximum Marks : 75

Note: Attempt only one question from each unit Q.No.1 is compulsory.

- Q.1 (a) Calculate the atomic packing factors for (3)
- (i) SCL
(ii) BCL
(iii) FCL
- (b) Within a cubic unit cell sketch the following direction (3)
- (i) $[1\ 1\ 1]$
(ii) $[0\ 1\ 1]$
(iii) $[1\ \bar{1}\ 1]$
- (c) Sketch within a cubic cell the following planes. (3)
- (i) $(0\ 0\ 1)$
(ii) $(1\ 1\ 1)$
(iii) $(1\ 2\ 1)$
- (d) Define a slip system. (2)
- (e) Cite the difference between mechanical and annealing terms. (2)
- (f) Differentiate between creep and rupture strength. (1)
- (g) Differentiate between annealing and normalizing. (1)
- (h) What is phase rule and what does it indicate. (2)
- (i) Give the allotropic forms of iron. (2)
- (j) Explain phenomena of season cracking and caustic embrittlement. (2)
- (k) For a polymer matrix fibre reinforced composite list three functions of the matrix phase. (2)
- (l) What is a hybrid composite, list an advantage of hybrid composite over fiber composite? (2)

UNIT-I

- Q.2 Cite the differences between recovery and recrystallization. Explain the differences in grain structural for a metal that has been cold worked and one that has been cold worked and recrystallised. (12.5)
- Q.3 Using neat sketches describe the creep curves. What is the Homologous temperature of Aluminum and Iron? (12.5)

UNIT-II

- Q.4 A hyper-eutectoid steel which was cooled slowly from γ -state to room temperature was formed to contain 10% eutectoid ferrite. Assume no change in structure occurred on cooling from just below the eutectoid temperature to room temperature. Calculate the carbon content of steel. (12.5)
- Q.5 Describe the effect of material variables on creep properties. What leads to brittle failure at low temperature? (12.5)

UNIT-III

- Q.6 Differentiate between austempering and martempering. Compare the hardness, percentage elongation and impact values obtained for 0.95% C steel after quench temper, austemper and martemper treatments. (12.5)
- Q.7 How can we classify steels on the basis of carbon percentages? Give their salient characteristics. What is the important characteristic of wear resistant steels? (12.5)

UNIT-IV

- Q.8 A continuous and aligned fiber reinforced composite having a cross-sectional area of 1130 mm² is subjected to an external tensile load. If the stresses sustained by the fiber and matrix phases are 156 MPa and 2.75 MPa respectively, the force sustained by the fiber phase is 74,000N and longitudinal strain is 1.25×10^{-3} , determine (12.5)
- (a) the force sustained by the matrix phase.
(b) the modulus of elasticity of the composite material in the longitudinal direction.
(c) the moduli of elasticity for fiber and matrix phases.
- Q.9 Describe briefly the different types of corrosion. What are the necessary methods used against corrosion. (12.5)
