Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(ME(N)/PE(N)/PWE(N)/AUE(N)/SEM-3/ME-303/2011-12

2011

ENGINEERING MATERIALS

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Atomic Packing Factor is maximum for

a) Prism b) Simple Cube

c) FCC d) BCC.

ii) The crystal structure of cementite is

a) FCC b) BCC

c) Tetragonal d) Rhombic.

iii) Which of the following bonds is the weakest ?

a) Ionic bond

b) Covalent bond

c) Metallic bond

d) Secondary Dipole bond.

iv) Gibbs Phase Rule for condensed state reaction under constant pressure is

a) $F + P = C + 2$ b) $F + C = P + 2$

c) $F + P = C + 1$ d) $F + 1 = C + P$.

v) Number of phases present at the triple point is

a) 1 b) 2

c) 3 d) none of these.

vi) In case of a screw dislocation, the angle between the Burger's vector and the dislocation line is

a) 0° b) 30°

c) 45° d) 90°.

vii) The slip system in an FCC crystal is

a) $\{ 100 \} < 100 >$ b) $\{ 110 \} < 110 >$

c) $\{ 110 \} < 111 >$ d) $\{ 111 \} < 110 >$.

viii) Chisels are generally made of

a) Dead mild steel b) Low carbon steel

c) Medium carbon steel d) High carbon steel.

ix) Solder is an alloy of

a) Cu – Zn b) Pb – Sn

c) Cu – Sn d) Cu – Sn – Ag.

x) At ductile - brittle transition (DBT) of a specimen, which one of the following relations holds good ?

a) $\sigma_y > \sigma_f$ b) $\sigma_f > \sigma_y$

c) $\sigma_f = 0$ d) $\sigma_f + \sigma_y$.

xi) The term 'sintering' is associated with
  a) welding technique
  b) die casting technique
  c) powder metallurgy technique
  d) soldering technique.

xii) Metal matrix composites are mostly made up of
  a) Metal matrix with metallic wires as reinforcement
  b) Metal matrix with ceramic fibres as reinforcement
  c) Metal metrix with polymeric fibres as reinforcement
  d) All these are applicable.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Prove that APF of HCP unit cell is 74%.

3. Explain the following :
  a) Primary bonds and Secondary bonds 3
  b) Edge and Screw dislocations. 2

4. Define the following :
  a) Phase diagrams 2
  b) Phase equilibrium 2
  c) Solubility limit. 1

5. a) Discuss normalizing heat treatment process. 3
  b) What are cast irons ? What is their basic range of composition ? 2

6. Why is cementite hard ? Explain "Martensite formation is a diffusionless process". Explain "Quenching is always followed by tempering." 1 + 2 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Define the following phases that are present in the Fe–Fe_3 C phase diagram :
   i) Austenite ii) α-Ferrite
   iii) Cementite iv) δ-Ferrite.
   b) What is the structure of pearlite ?
   c) Distinguish between the following three types of plain carbon steels :
   i) Eutectoid
   ii) Hypoeutectoid
   iii) Hypereutectoid. 8 + 2 + 5

8. a) What is creep in metal and fracture strength ?
   b) What is the difference between the slip and twining mechanism of plastic deformation of metals ?
   c) Draw the stress-strain curve for mild steel and cast iron.
   d) What do you mean by toughness and malleability of steel ? What is ductility ? 4 + 3 + 3 + 5

9. a) Define corrosion pertaining to materials. What are some of the factors that affect the corrosion of materials ?
   b) What are the forms of corrosion ? Explain the pitting corrosion.
   c) Explain stainless steel and effect of corrosion on it. (5 + 7 + 3)

10. a) State and explain different types of corrosion in materials. 7
    b) How is corrosion controlled ? 8

11. a) What is polymerization ? Describe the mechanism of polymerization.
    b) State the difference between the thermoplastics and thermosets material.
    c) Predict the coordination number for the ionic solids CsCl and NaCl. Use the following ionic radii for the prediction :
    Cs^+ = 0·170 nm, Na^+ = 0·102 nm, Cl^- = 0·181 nm.
    d) Describe the sintering process. (1 + 4) + 3 + 3 + 4