Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (ME) NEW/PE(N)/PWE(N)/AUE(N)/SEM-3/ME-303/2012-13

2012

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 the following : $10 \times 1 = 10$

i) The cause of hydrogen bonding is

a) dipole bonding

b) van der Waals' bonding

c) ionic bond

d) all of these.

ii) The equation $n = 2d \sin \theta$ represents

a) Bragg's law

b) Miller indices

c) Atomic packing factor

d) None of these.

iii) A considerable amount of undercooling required for which of the following types of nucleation ?

a) Homogeneous

b) Heterogeneous

c) Both (a) and (b)

d) All of these.

iv) In the imperfection of crystal structure the displacement distance of the atoms around the dislocation is called

a) Twin

b) Slip

c) Imperfection

d) Exceed order quantity.

v) The ability of the material by virtue of which it can be drawn into a wire is known as

a) Malleability b) Drawing

c) Fatigue d) all of these.

vi) The assignment matrix is

a) identity matrix

b) null matrix

c) square matrix

d) rectangular matrix.

vii) The electrical resistivity of normal metal and alloy decreases steadily as the temperature decreases and reaches a low residual value. This phenomenon is called

a) Hysteresis

b) Superconductivity

c) Conductivity

d) All of these.

viii) The conversion of metal to its metallic oxide and salts is known as

a) pitting b) oxidation

c) corrosion d) none of these.

ix) Magnesium present in the alloy steel increases the property of

a) Magnetism b) Hardness

c) Toughness d) All of these.

x) Cast iron is a family of ferrous alloy with a wide range of properties and as their name implies because

a) they are intended to be cast into the desired shape instead of being worked in these

b) it contains 2 to 4% carbon

c) it also contains 1 to 3% silicon

d) all of these.

GROUP – B

(Short Answer Type Questions)

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

2. a) What is meant by fracture of a material ? Name different kinds of fracture and give sketches. 2

b) Define fracture toughness of a material. 1

c) A high strength steel is having yield stress of 1460 MPa and K_{ic} = 98 MPa $\sqrt{m}$. Calculate the size of the surface crack that will lead to its catastrophic failure at an applied stress of $\frac{1}{2}$ Y.P. stress. 2

3. a) Write down Hall-Petch equation for strengthening of materials and alloys by controlling the grain size. 1

   b) Find the grain diameter of an austenitic grain size No. 6. 2

   c) Draw neat sketch of creep phenomenon showing different shapes. 2

4. Show the difference between Martempering and Austempering.

5. For gear and axle in an automobile what sort of heat treatment should be suggested ?

GROUP – C

(Long Answer Type Questions)

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

6. a) What do you mean by Phase ? Write Gibbs' Phase Rule and explain all the terms used in this equation. What are the information that we may get from the phase diagram ? 1 + 4 + 3

   b) Draw an iron carbon phase diagram showing eutectoid, eutectic and peritectic points with all the temperatures and carbon percentages. 7

7. a) A 0·40% C hypoeutectoid plain-carbon steel is slowly cooled from 940°C to a temperature just slightly above 723°C.

   i) Calculate weight per cent austenite present in the steel.

   ii) Calculate the weight per cent proeutectoid ferrite present in the steel. $4\frac{1}{2}$

   b) A 0·40% C hypoeutectoid plain-carbon steel is slowly cooled from 940°C to a temperature just slightly below 723°C.

   i) Calculate weight per cent proeutectoid ferrite present in the steel.

   ii) Calculate the weight per cent eutectoid ferrite and weight per cent eutectoid cementite present in the steel. $4\frac{1}{2}$

   c) Why is heat treatment necessary for ferrous metals and alloys ? Differentiate between Martempering and Austempering. What are the different case hardening methods that are used in heat treatment process ? Explain nitriding method. 2 + 2 + 2

8. a) Define corrosion. What are the factors that affect the corrosion of a metal ? 1 + 3

b) Explain corrosion due to galvanic action and pitting corrosion. What are the methods to prevent corrosion on the surface of the metal ? 4 + 3

c) What is creep ? Draw a continuous loading creep diagram at fixed temperature. 1 + 3

9. a) What is radius ratio ? Predict the coordination number for the ionic solids CsCl and NaCl. Use the following ionic radii for the prediction

$Cs^+ = 0{\cdot}170$ nm $Na^+ = 0{\cdot}102$ nm $Cl^- = 0{\cdot}181$ nm.

2 + 3

b) Differentiate between thermoplastics and thermosetting plastics. Give examples of each of them. Why plastics are considered as modern engineering materials ?

5 + 2 + 3