



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 × 1 = 10

i) The cause of hydrogen bonding is

- a) dipole bonding
- b) van der Waals' bonding
- c) ionic bond
- d) all of these.

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[Turn over



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. $3 \times 5 = 15$

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 $K_{ic} = 98 \text{ MPa } \sqrt{\text{m}}$. 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
- $Cs^+ = 0.170 \text{ nm}$ $Na^+ = 0.102 \text{ nm}$ $Cl^- = 0.181 \text{ nm}$.
- 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
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