



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.



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.

- ## GROUP – B

Answer any *three* of the following. $3 \times 5 = 15$

- 3265 (N)



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. $3 \times 15 = 45$

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.

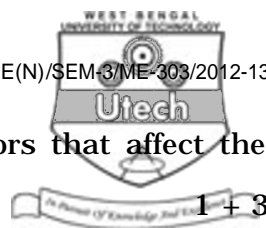
ii) Calculate the weight per cent proeutectoid ferrite present in the steel. $4 \frac{1}{2}$

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
- $\text{Cs}^+ = 0.170 \text{ nm}$ $\text{Na}^+ = 0.102 \text{ nm}$ $\text{Cl}^- = 0.181 \text{ nm}$.
- 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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