B.Tech/ME/3rd Sem/MECH-2104/2015

2015

ENGINEERING MATERIALS

(MECH2104)

Time Alloted : 3 Hours ***Full Marks : 70***

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer 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) Which of the following bonds is the weakest?

   (a) Ionic bond (b) Covalent bond
   (c) Metallic bond (d) Secondary di-pole bond

   ii) 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

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

   (a) Ductility (b) Hardness
   (c) Toughness (d) Britleness

   iv) The cause of hydrogen bonding is

   (a) dipole bonding (b) Vander Waal's bonding
   (c) Ionic bond (d) both (b) & (c)

   v) Which of the following is magnetic allotrope of iron?

   (a) α-iron (b) β-iron
   (c) γ-iron (d) δ-iron

   vi) 'a' is the lattice parameter of a BOC crystal, the distance between two nearest neighbours are

   (a) $\frac{\sqrt{3}}{2}a$ (b) 2a
   (c) $\frac{\sqrt{2a}}{3}$ (d) $\sqrt{3}$

   vii) An increase in the percentage of carbon results into decrease in its

   (a) Hardness (b) Ductility
   (c) Ultimate strength (d) Corrosion resistance

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

   (a) Bragg's law (b) Miller indices
   (c) Atomic packing factor (d) none of these

   ix) Crystal structure is studied by

   (a) Metallographic technique
   (b) X-ray technique
   (c) Ultrasonic method
   (d) Electron microscopy

   x) Pearlite is a mixture of cementite and

   (a) Ferrite (b) Austenite
   (c) Bainite (d) Mertensite

GROUP - B

2. (a) Mention the differences between the slip and twinning mechanism for plastic deformation of metals.

   (b) With the help of neat sketches, explain how the slip occurs by the movement of edge dislocation.

   6+6 = 12

3. (a) Discuss the major differences between Ionic bonding, Covalent bonding & Metallic bonding.

   (b) What do you mean by point defects? Name their types with the corresponding sketches. **6+6 = 12**

GROUP - C

4. (a) Name any two non-ferrous alloys mentioning their compositions, properties and applications.

   (b) Write short notes of (i) TTT Curves, (ii) Age Hardening heat treatment, (iii) Normalising. **6+6 = 12**

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

   (b) What is carburizing? Why is it necessary to harden and temper the component after carburizing. **6+6 = 12**

Group - D

6(a) Define brinnel hardness number and from definition show that brinnel no N is given by

$$N = \frac{191}{10 - \sqrt{100 - d^2}}$$

where diameter of steel ball is 10mm, the load is 3000kg and diameter of impression is d. What would be the corresponding formula for 10mm ball and 500kg load?

(b) Distinguish between ductile fracture and brinnel fracture.

6+6 = 12

7. (a) In order to evaluate various mechanical properties of a steel specimen of 12.5 mm diameter and 62.5 mm gauge length was tested in a standard tension test. Yield load = 40.0 KN; Maximum load = 71.5 KN; Fracture load = 50.5 KN; Gauge length at fracture = 79.5mm; strain at load of 20 KN = 7.75×10^{-4}. Determine : (i) modulus of elasticity, (ii) Modulus of resilience, (iii) Modulus of toughness.

   (b) A fatigue test was conducted in which the mean stress was 70 MPa and the stress amplitude was 210 MPa. Compute the following : (i) The maximum and minimum stress levels, (ii) Stress ratio, (iii) Stress range, (iv) The total stress. **6+6 = 12**

GROUP - E

8. (a) Distinguish between thermoplastics & thermo setting plastics using any three of their characteristics.

   (b) Mention the general properties of the polymeric materials. What are the major applications of elastomers?

   6+6 = 12

9. (a) Define corrosion and discuss types of corrosion usually encountered.

   (b) What do you understand by (i) Season cracking of Brass, (ii) caustic embrittlement of boiler plate. **6+6 = 12**
