[Total No. of Questions - 9] [Total No. of Printed Pages - 3] (2064)

14693

B. Tech 4th Semester Examination

Material Science & Engineering (O.S.)

ME-4042

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each section A, B, C & D and all the subparts of the questions in Section E.

SECTION - A

1. (a) The density of iron is 7.86 gm/cm^3 and the atomic weight is 55.85. Calculate its atomic radius. (10)

   (b) How is the crystal structure of sodium chloride different from the crystal of sodium and unit cell of chlorine? (10)

2. (a) The ratio of the intercepts of an orthorhombic unit cell are a:b:c = 0.429:1:0.379. What are the Miller indices of faces with the following intercept? (10)

   (b) Enumerate various techniques employed in determining the crystal structure of solids. Compare their advantages and disadvantages. (10)

SECTION - B

3. What is a slip plane? How is it related to dislocation? Explain with the help of a diagram, the slip plane and slip directions in FCC, BCC and HCP crystals. (20)

4. Which mechanism of diffusion takes place in nickel-FCC iron system? How can you determine the number of effective jumps per unit item? (20)

SECTION - C

5. (a) What is fatigue? What are its effect on properties of materials? Describe the fatigue limit and its criticality in aeroplanes. (12)

   (b) Discuss the mechanism of fatigue failure. (8)

6. Enumerate different creep laws in various materials. Show as to how the variation in temperature and the stress influence the creep behaviour of a material. (20)

SECTION - D

7. (a) Compare hard and soft magnetic materials. Why is a soft magnetic material preferred over a hard magnetic material for use in the transformer core? (14)

   (b) Discuss the concept of polarizability. (6)

8. (a) What are dielectrics? Prepare a list of different types of insulating materials. Write their properties and applications also. (14)

   (b) What is super conductivity? How it is different from conductivity? (6)

SECTION - E

9. (a) Define atomic packing factor.

   (b) What is the importance of Miller indices? How does it help in the study of crystallography?

   (c) Screw dislocation cannot glide whereas edge dislocation can. Explain why?

(d) Young's modulus of graphite is much lower than that of steel, and this value for diamond is about 5 times that of steel. Why so-explain?

(e) Discuss free electron theory from view point of conductivity.

(f) Explain self diffusion and inter diffusion processes.

(g) What are the effects of dipole moments on the magnetic behaviour of materials?

(h) What do you understand by Type I and Type II superconductors?

(i) Classify magnetic materials with suitable examples.

(j) The atomic radius of copper is 1.278 Å. Find the density of copper. (2×10=20)