[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2063)

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B.Tech 4th Semester Examination

Material Science & Engg.

ME-4052

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 question in section E.

SECTION - A

1. (a) Differentiate between FCC and HCP unit cells with the help of diagrams. Describe the geometries of HCP crystal structure. **(10)**

   (b) Sodium chloride crystal of FCC structure has a density of 2.18 gm/cm^3. Calculate the distance between two adjacent atoms in it. **(10)**

2. (a) What is 'Screw dislocation'? Show Burgers circuit and Burgers vector on a crystal which has a screw dislocation. **(10)**

   (b) Discuss Fick's laws of diffusion. Write stepwise expressions to explain them. **(10)**

SECTION - B

3. (a) The resilience of strong metals increases when they are used in slender shapes such as leaf springs in auto vehicles, or as spiral springs in watches-why? **(10)**

   (b) Enumerate different types of semiconductors. Intrinsic semiconductors are not suitable for applications in electronic devices-why? **(10)**

4. (a) Why do the blades of gas turbine creep? What are the different stages in the creep curve? **(10)**

   (d) Discuss the mechanism of polarization. **(10)**

SECTION - C

5. (a) Differentiate between the following:

   (i) Diamagnetism and Paramagnetism.

   (ii) Ferromagnetism and Ferrimagnetism. **(14)**

   (b) Explain magnetic hysteresis curve. Why it is called hysteresis curve? **(6)**

6. Classify superconductors. Differentiate between ideal superconductors and hard superconductors. Write the applications of superconductors stating their limitations. **(20)**

SECTION - D

7. There is 5% probability for an electron to occupy an energy state which is 0.4eV above the Fermi energy. Estimate the temperature at which this can happen. **(20)**

8. Discuss in detail the concept of polarizability and internal fields. **(20)**

SECTION - D

9. (a) What is a crystal imperfection? Give the list of imperfection.

   (b) Draw (111) and (1010) planes on cubic and hexagonal unit cells as the case may be.

   (c) What is Kirkendall effect?

   (d) Discuss Hall effect and its application.

   (e) Discuss the mechanism of fatigue failure.

   (f) What is super conductivity?

   (g) What is the difference between Soft and Hard magnetic materials?

   (h) Describe Burger vector.

   (i) Explain the effect of critical magnetic field.

   (j) What are dielectrics? **(2×10=20)**