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(2064)

14605

B. Tech 2nd Semester Examination

Engineering Physics-II (N.S.)

NS-105

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 : Attempt five questions in all, select one question from each sections A, B, C and D. Section E (question 9) is compulsory.

SECTION - A

1. (a) What do you understand by Miller indices of a crystal plane? Write their significance. Derive expression for interplanar spacing for planes of the (h,k,l) type in case of a cubic structure. (8)

   (b) Draw (1,1,0) and (1,1,1) planes for a simple cubic crystal. The Bragg angle corresponding to the first order reflection from (1,1,1) planes in a crystal is 30° when x-ray of wavelength 1.75A° are used. Calculate the interatomic spacing. (8)

   (c) Calculate c/a ratio for an ideal hexagonal close packed structure. (4)

2. (a) Derive Richardson equation and mention its importance. (12)

   (b) Calculate the temperature at which there is 1% probability that a state with an energy 0.2 eV above Fermi energy, will be occupied by an electron. (8)

SECTION - B

3. (a) Discuss Kronig-Penney model for a linear lattice. How does it lead to the formation of energy bands in solids? What happens to the width of the allowed and forbidden bands with the change in the strength of the periodic potential? (15)

   (b) Discuss the concept of effective mass. (5)

4. (a) Explain the origin of energy bands in solids. (8)

   (b) What are Brillouin zones? How are they related to the energy levels of an electron in a metal? Draw the Brillouin zones for a two dimensional square lattice of side “a”. (12)

SECTION - C

5. (a) Define electric flux density and polarization. Obtain relationship between them. (6)

   (b) Discuss in detail the theory of dielectrics in alternating field. Obtain an expression for the dielectric constant in terms of frequency and relaxation time. (7)

   (c) Explain the origin of permanent magnetic moments. (7)

6. (a) Draw B-H curve for a ferromagnetic material and explain the different stages of magnetization process on the basis of domain theory. (8)

   (b) Explain types of polarizations. (7)

   (c) A superconducting material has a critical temperature of 4.1K in zero magnetic field and a critical field of 0.0203 Tesla at 0K. Determine the critical field at 2K. (5)

SECTION - D

7. (a) Explain spontaneous and stimulated emission. Derive the relationship between Einstein’s coefficients. (10)

(b) Distinguish between step index and graded index optical fibres. (5)

(c) An optical fibre has a numerical aperture of 0.22 and a cladding refractive index of 1.58. Find acceptance angle for the fibre in water which has a refractive index of 1.33. (5)

8. (a) Discuss components of a laser system. (9)

(b) Discuss the application of optical fibres in communication. (6)

(c) Find the intensity of laser beam of 15mW and diameter 1.3mm. Assume the intensity to be uniform throughout the beam. (5)

SECTION - E

9. (a) Distinguish between polar and nonpolar dielectrics. (2)

(b) State Gauss's law in presence of dielectric. (2)

(c) Explain Bragg's law for x-ray diffraction in crystals. (2)

(d) What is Fermi distribution function? (2)

(e) What is thermionic emission? Explain its significance. (2)

(f) Explain significance of Hysteresis curves. (2)

(g) What are high temperature superconductors? Mention their one application. (2)

(h) How population inversion is important for laser emission? (2)

(i) What is numerical aperture? (2)

(j) What is meant by an acceptance angle? (2)