16025(J)   J-16

B. Tech 2nd Semester Examination

Engineering Physics-II (NS)

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. Assume the missing data.

SECTION - A

1. (a)   Define the terms : unit cell, lattice, basis and crystal structure. What is Bravias lattice? Discuss with suitable example.   (10)

    (b)   What is interplanar spacing? Derive expression for it. Calculate interplanar spacing for the lattice plane of Miller indices (321) for a cubic lattice with lattice parameter $a=5.62A°$.   (10)

2. (a)   What do you understand by diffraction of X-rays? Discuss Bragg's law for the diffraction of X-rays by crystals. The angle of reflection for monochromatic X-rays for a crystal whose atomic spacing is $2.5 A^0$ is $45°$. Calculate the wave length of X-rays.   (10)

    (b)   Discuss classical free electron theory. Mention its main drawbacks.   (10)

[P.T.O.]

SECTION - B

3. (a)   Explain the difference between a metal, a semiconductor and an insulator on the basis of energy band gap. Discuss Kronig-Penney model briefly.   (15)

    (b)   Discuss the significance of effective mass of the electron.   (5)

4. (a)   What is Fermi energy? Discuss its dependence on temperature. The Fermi level for potassium is 1.99eV. Calculate the velocity of the electrons at the Fermi level.   (10)

    (b)   Draw the Brillouin zones for a two dimensional square lattice of side "a".   (10)

SECTION - C

5. (a)   What do you mean by polarization of dielectrics? Explain various types of polarization.   (10)

    (b)   Draw and explain B-H graph for ferromagnetic material and discuss its significance.   (10)

6. (a)   The dielectric constant of helium at 0°C and one atmospheric pressure is 1.000074. Determine the dipole moment induced in each helium atom when the gas is in an electric field of intensity $9×10^5 V/m$.   (10)

    (b)   Explain the soft and hard superconductors.   (10)

SECTION - D

7. (a)   Distinguish between spontaneous and stimulated emission. Explain various components of laser system.   (10)

    (b)   Discuss various losses in optical fibers. How they can be minimized?   (10)

8. (a) Obtain the relationship between Einstein's coefficients using concept of interaction of radiation with matter and discuss its significance. (10)

   (b) Distinguish between single mode and multimode fibers. What are main advantages of optical fibers over conducting wires? (10)

SECTION - E

9. (a) Discuss four level pumping scheme in lasers.

   (b) Draw [111] and [$\bar{1}\bar{1}$1] directions in a cubic crystal.

   (c) Define dielectric constant. How it is determined experimentally?

   (d) Draw structure of optical fiber cable.

   (e) Draw block diagram of optical fiber communication system.

   (f) Why are ferrites preferred over ferromagnetic materials at high frequency as a core material?

   (g) Define persistent current and critical temperature.

   (h) Determine the Millar indices of a plane that makes intercepts on a, b, and c, axes equal to 3A°, 4A°, and 3A° in a tetragonal crystal with c/a ratio as 1.5.

   (i) Distinguish between ferri-magnet and ferromagnetic materials.

   (j) What do you mean by optical window? (2×10=20)