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(2063)

802

B.Tech 2nd Semester Examination

Engineering Physics

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) Establish the relation between the edge of the unit cell and atomic radius for the bcc and fcc lattice. Derive the relation between the lattice constant of a cubic crystal and the density of crystal material. **(8)**

   (b) Draw (111) and (111) planes inside the unit cell of a cubic crystal. Determine the Miller indices of the direction that is common to both planes. **(8)**

   (c) Show analytically that five-fold rotation axis does not exist in a crystal lattice. **(4)**

2. (a) What are density of states in metals? Derive an expression for density of energy states and hence obtain Fermi energy of a metal. **(12)**

(b) Discuss the classical theory of electron gas. What are the drawbacks of classical theory? **(8)**

SECTION - B

3. (a) Discuss the band theory of solids. How does this theory lead to the classification of solids into conductors, semiconductors and insulators? **(12)**

(b) Find the ratio between the kinetic energies of an electron in a two dimensional square lattice (a) when $k_x=k_y=\pi/a$ and when $k_x=\pi/a$, and $k_y=0$. **(8)**

4. (a) What are Brillouin zones? Explain their importance. How are they related to the energy levels of an electron in a metal? **(7)**

(b) What is meant by Fermi level in a metal? How does it vary with temperature in a metal. Show diagrammatically where the Fermi level exist in (i) a metal (ii) intrinsic semiconductor. **(7)**

(c) Fermi energy of copper is 7eV. Calculate (a) The Fermi momentum of electron in copper. (b) de Broglie wavelength of the electron and (c) the Fermi velocity. **(6)**

SECTION - C

5. (a) Explain what is meant by polarization in dielectrics. Obtain the relation between dielectric constant and atomic polarizability. **(6)**

(b) Discuss theory of antiferromagnetism. **(7)**

(c) Discuss the behaviour of a normal conductor in presence of magnetic field, when it is cooled to a temperature below critical temperature. **(7)**

6. (a) Discuss the behavior of dielectric in alternating field. **(7)**

(b) Distinguish between soft & hard magnetic materials and mention their applications. **(7)**

(c) Discuss BCS theory of superconductivity. **(6)**

SECTION - D

7. (a) Discuss the construction and working of He-Ne laser. What is the role of He in this laser? What is efficiency of this laser? **(15)**

(c) Discuss one sensing application of optical fibres. **(5)**

8. (a) Explain the principle of lasers. What are the characteristics of laser beam. Can we obtain laser beam from spontaneous emissions? Explain. **(7)**

(b) Discuss attenuation in optical fibres. **(8)**

(c) An optical fibre has an attenuation of 3.8dB/km at 850nm. if 0.4m W of optical power is initially launched with fibre, calculate the power level after 8km. **(5)**

SECTION - E

9. (a) What are dielectrics? Write their important uses. **(2)**

(b) What are ferrites? Mention their applications. **(2)**

(c) What is coordination number? What factors control the coordination number? **(2)**

(d) Explain the concept of negative effective mass. **(2)**

(e) Write Richardson's equation and discuss its importance. **(2)**

(f) Discuss briefly importance of dipole moments in classification of magnetic materials. **(2)**

(g) What are cooper pairs? **(2)**

(h) Mention main applications of Ruby laser. **(2)**

(i) Explain the principle of optical fibre communication. **(2)**

(j) Explain briefly pulse dispersion in optical fibres. **(2)**