2018

2nd Semester

ELECTRONICS

PAPER—C3T

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Applied Physics

1. Attempt any *five* of the following : 5×2

(a) Define Bravais lattice and unit cell.

(b) What is phonon ?

(c) Show that a bond can accommodate 2N electrons where N is the number of atoms in the crystal.

(d) Show that the number of possible wave function in any energy band is equal to the number of unit cells.

(e) Why ionic solids are poor conductors of electricity ?

(f) Give the dimenssion of magnetic susceptibility.

(g) Explain the origin of diamagnetism in free atom.

(h) Plot the variation of conductivity with temperature in metal and semiconductor.

2. Answer any *four* of the following : 4×5

(a) Define Miller indices of a plane in a crystal. What are the utility and significance of Miller indices ?

$2+(1\frac{1}{2}+1\frac{1}{2})$

(b) What is reciprocal lattice ? Show that every reciprocal lattice vector is perpendicular to a direct lattice plane.

2+3

(c) In what way the Einstein's theory of specific heat is superior to classical theory ? 5

(d) Draw the E-K diagrams for a direct band gap and an indirect bandgap material. $2\frac{1}{2}+2\frac{1}{2}$

(e) What are the main conclusions of Kronig-Penney model treatment? Draw schematically the energy-wave vector diagram for a crystal. $2\frac{1}{2}+2\frac{1}{2}$

(f) Show that the effective freedom of electrons in an energy band in a solid is maximum when the band is filled upto the inflexion point of E-K curve and zero when completely filled. 3+2

3. Answer any *one* of the following : 1×10

(a) Show that at very low temperatures, the internal energy of a vibrating lattice following Debye's theory is proportional to T^4.

In alluminium, the transverse and longitudinal waves propagate with velocities 3111 m/s and 6374 m/s respectively. Assuming that the number of atoms per m^3 of aluminium is 6.02×10^{28}, find the Debye frequency and Debye characteristic temperature for aluminium. 6+(2+2)

(b) Compare the basic postulates of the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statics. Find the Fermi energy for a metal at T = 0 k.

4+6