2018

M.Sc. 1st Seme. Examination

ELECTRONICS

PAPER—ELC-103

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

Electronic Materials

1. Answer any *four* questions : 4×2

(a) What are F and V centers ?

(b) Define Fermi surface.

(c) Mention the uses of Hall effect.

(d) Why does the field seen by the dipoles in a solid differ from the applied field ?

(e) What is an intraband transition ?

(f) Explain the terms : soft and hard magnetic materials.

(g) What is a coopr pair ?

(h) Name a few high-T_c superconductors.

2. Answer any *four* questions : 4×4

(a) What is meant by crystal imperfections ? Classify them in the order of their geometry. 1+3

(b) State the basic assumptions of the classical Drude theory of metals. Define relaxation time. 2+2

(c) Deduce the Hall coefficient in a metal where the carriers are only electrons.

(d) Establish the relationship among the electric displacement, field strength and polarization vectors.

(e) Write a note on ferroelectricity.

(f) Calculate the characteristic penetration depth of Al for Na light (λ = 589 nm, k = 6). What is an absorbance ?

2+2

(g) Derive an expression showing the temperature dependence of paramagnetic susceptibility.

(h) What is a Meissner effect ? Show that a soft superconductor is a perfect diamagnetic material.

2+2

3. Answer any *two* questions : 2×8

(a) Explain with neat sketches the line defects in crystals. How does the Burgers vector identify the defects ?

6+2

(b) The following data are given for Cu :

Density = 8.92×10^3 kg/m^3

Resistivity = 1.73×10^{-8} Ω –m

Atomic weight = 63.5

Calculate the average time of collision of electrons in copper, obeying classical law.

Derive the Boltzmann transport equation. 3+5

(c) Obtain an expression for the orientational polarization neglecting dipole-dipole interactions. Discuss what happens at high and low temperature. 5+3

(d) For lead, the critical field at 0K is 6.39×10^4 A/m and the critical temperature for zero magnetic field is 7.18K. Find the critical field for lead at 4K. What is a Joesphson junction ? Explain dc Josephson effect. 2+1+5

Internal Assessment — 10