2017

M.Sc.

1st Semester Examination

ELECTRONICS

PAPER—ELC-103

Subject Code—27

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)

Answer Q. No. *1* and any *three* from the rest.

1. (a) What is Burgers vector ?

(b) What do you understand by "free electron gas" ?

(c) Explain dielectric relaxation.

(d) Draw a critical T-H-I diagram for super-conductors and explain.

(e) Why ferrites are superior to ferromagnetic materials ?

5×2

2. (a) What is meant by crystal imperfections ? Classify them in order of geometry.

(b) Derive an expression for density of Schottky defects in ionic crystals. (2+3)+5

3. (a) Derive an expression for the density of states and hence show that at 0 K, the average energy of electron is $\frac{3}{5}$ th the Fermi energy.

(b) Determine the internal energy of the electron gas per unit volume at 0K for metallic silver containing one free electron per atom.

The density and atomic weight of silver is 10.5 g cm^{-3} and 108 respectively. (3+4)+3

4. (a) Find an expression for electronic polarization of a gas atom of radius R. Does the electronic polarization vary with temperature ?

(b) Silicon has the dielectric constant 12, and the edge-length of the conventional cubic cell of silicon lattice is 5.43 $\mathring{A}$. Calculate the electonic polarizability of silicon atoms.

(c) What is the physical significance of complex dielectric constant ? (4+1)+3+2

5. (a) Describe the structure of ferrites. How is the magnetic moment of ferrite molecule calculated ?

(b) Derive the magnon dispersion relation for a spin S on a simple cubic lattice. (3+3)+4

6. (a) Distinguish between type–I and type–II super-conductors. Name some materials belonging to these two types of superconductors.

(b) Show that in an ac Josephson effect current oscillates with frequency

$\omega = \frac{2eV}{h}$, where the symbols have their usual meanings.

What is an inverse ac Josephson effect ?

(2+1+1)+(4+2)

[Internal Assessment — 10 Marks]