

**2016****M.Sc.****1st Semester 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)**

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

1. (a) What do you mean by 'Fermi Surface'?
- (b) Classify different imperfections in crystals.
- (c) What is Hall effect?
- (d) Distinguish between type-I and type-II superconductors.

*(Turn Over)*

- (e) Stoichiometric ZnO is an insulator but non-Stoichiometric ZnO is an n-type semiconductor. Explain.

5×2

2. (a) What are the different contributions to the total polarization of a dielectric material?
- (b) Obtain an expression for the internal field in a solid dielectric.
- (c) Give reason why in  $\text{Fe}_3\text{O}_4$ , some of the magnetic  $\text{Fe}^{2+}$  ions are replaced by non-magnetic ions such  $\text{Zn}^{2+}$  or  $\text{Cd}^{2+}$ , the magnetization increases.

3+4+3

3. What is Meissner effect? Show that a soft superconductor is a perfect diamagnetic material. What is superconducting energy gap? Name the experimental evidence in support of that. What are cooper pairs?

2+3+2+1+2

4. Establish the Boltzmann transport equation (BTE). With the help of BTE, show that the electrical conductivity of a free electron gas is  $\sigma = ne^2\tau/m$ , where the symbols have their usual meanings.

5+5

5. (a) Describe with suitable diagrams edge dislocations and screw dislocations in crystal lattice.
- (b) Obtain the expression for the difference of entropy between the normal and the superconducting states of a specimen.

$$\left(2\frac{1}{2} + 2\frac{1}{2}\right) + 5$$

6. (a) What are the characteristics of ferromagnets? Derive the Curie-Weiss law for their susceptibility.
- (b) What do you mean by photoluminescence and electroluminescence?
- (c) What are colour centers?

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

**Internal Assessment — 10 Marks**

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