PG/IIS/EL-1203/10

M.Sc. 2nd Semester Examination, 2010

ELECTRONICS

(*Electronic Materials*)

PAPER—EL-1203

(Theory)

Full Marks : 40

Time : 2 hours

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

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

1. Answer any *five* questions : 2×5

(*a*) Why a Schottky defect is called a point defect and dislocation a line defect ?

(*b*) What is Hall effect ? 'Hall coefficient is positive in some metals'—why ?

(*c*) Write Bollzmann transport equation and explain.

(*d*) Draw a critical T-H-I diagram for superconductors and explain.

(*e*) Give reason on which side you will illuminate a *p-n* junction solar cell to get a better performance. What is the structural difference in between the crystalline and amorphous silicon solar cells ?

(*f*) What do you mean by spin wave ?

2. (*a*) Describe with suitable diagrams, edge dislocations and screw dislocations in crystal lattice.

(*b*) If 1 eV is required to move an atom from the interior of a crystal to its surface, what is the proportion of vacancies present in the crystal at 1000 K and at 300 K ? $\left(3\frac{1}{2}+3\frac{1}{2}\right)+\left(1\frac{1}{2}+1\frac{1}{2}\right)$

3. (*a*) How does the electrical conductivity of a metal vary with : (*i*) impurity content, (*ii*) temperature ?

(*b*) Obtain a general expression for Fermi energy of electrons in a metal at absolute zero. Show that at the same temperature, the average energy of electrons is 3/5 th of the Fermi energy. (1 + 2) + (5 + 2)

4. (*a*) What are the different ferroelectric phases of barium titanate ? Explain spontaneous polarization.

(*b*) What are conducting polymers ? Explain the conduction mechanism in polyacetylene. (2 + 3) + (1 + 4)

5. (*a*) Distinguish between type-I and type-II superconductors. Name some materials belonging to these two types of superconductors.

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

$$w = \frac{2eV}{\hbar}$$

Where the symbols have their usual meanings. What is an inverse ac Josephson effect ? (2 + 1 + 1) + (4 + 2)

6. Write notes on any *two* : 5×2

(*i*) Oxide semiconductor

(*ii*) Quantum well

(*iii*) Optoelectronic material.