2 0 1 7

ELECTRONICS

(Major)

Paper : 1.1

(Material Science)

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Write 'Yes' or 'No' of the following :　　1×7=7

   (a) Temperature coefficient of resistance of semiconductor is positive.

   (b) Semiconductor counterpart of vacuum tube triode is *P-N* junction.

   (c) *I-V* characteristic of an Ohmic contact is similar to that of a rectifying junction.

   (d) An intrinsic semiconductor when doped with pentavalent atoms become *p*-type.

   (e) Photoluminescence intensity of solar cell materials must be higher than that of materials used in LED.

　　　　　　　　　　　　　(*Turn Over*)

(f) A semiconductor device having metal-insulator-semiconductor junction is BJT.

(g) Conduction band is an electrically inert band at 0 °K.

2. Answer the following questions : 2×4=8

(a) On increase in temperature, an extrinsic semiconductor becomes more and more intrinsic. Why?

(b) Name any two direct band gap semiconductors.

(c) Define degenerate semiconductor and Fermi energy.

(d) Draw graphs to show the variation of Fermi factor with energy at 0 °K and at room temperature.

3. Answer any *three* of the following questions : 5×3=15

(a) Draw the energy-band diagrams for conductor, insulator and semiconductor indicating the position of Fermi level in each case.

(b) Write a short note on superconducting materials.

(Continued)

(c) Describe various types of crystal lattices and mention their distinguishing features.

(d) Write briefly on the essential characteristics of solar cell materials.

(e) A sample of GaAs has a free electron density of 10^{17} cm^{-3} at 300 K. Calculate the position of the Fermi level at 300 K.

4. Answer any *three* of the following questions : 10×3=30

(a) Discuss the Kronig-Penney model for the motion of an electron in a periodic potential. 10

(b) Describe Langevin's theory of paramagnetism. What are its limitations? 8+2=10

(c) Distinguish between intrinsic and extrinsic semiconductors. Obtain an expression for carrier concentration of an intrinsic semiconductor. 4+6=10

(d) What are the two processes of current conduction in semiconductors? Write on them deducing necessary expressions for the corresponding currents. 2+4+4=10

(Turn Over)

(4)

(e) Describe the structure of a vacuum tube triode. Draw its *I-V* characteristic. 7+3=10

(f) Write short notes on the following : 5+5=10

 (i) Metal-insulator-semiconductor junction

 (ii) Polymer materials

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