

**DIPLOMA IN ELECTRICAL ENGINEERING  
(DELVI)****Term-End Examination****June, 2017**

00354

**OIEE-002 : ELECTRICAL ENGINEERING MATERIALS***Time : 2 hours**Maximum Marks : 70*

**Note :** Answer any **five** questions. All questions carry equal marks. Use of scientific calculator is allowed.

1. Mobilities of electrons and holes in a sample of intrinsic Germanium at room temperature are  $3600 \text{ cm}^2/\text{V-s}$  and  $1700 \text{ cm}^2/\text{V-s}$  respectively. If the electron and hole densities are each equal to  $2.2 \times 10^{13}/\text{cm}^3$ , calculate the conductivity of the sample. Derive the formula used. 14
2. Define the terms mobility and relaxation time. A uniform silver wire has a resistivity of  $1.54 \times 10^{-8} \Omega \text{ m}$  at room temperature. For an electric field along the wire at 1 volt/cm, compute the average drift velocity of the electrons, assuming there are  $5.8 \times 10^{23}$  electrons per  $\text{m}^3$ . Also calculate the mobility and relaxation time of the electrons. 4+10

3. (a) Explain the factors affecting the electrical resistance of materials. 7
- (b) Define the thermal conductivity of solid materials. Mention its unit. 7
4. What insulating materials would you select for the following ? Give reasons for your answer.  $4 \times 3 \frac{1}{2} = 14$
- (a) Commutation in dc machines
- (b) Spark plugs
- (c) Switch for domestic purposes
- (d) Winding of dc machines
5. (a) Derive the expression for the electronic polarizability of a conducting metallic sphere of radius R. 7
- (b) Explain the factors influencing the characteristics of insulating system. 7
6. (a) What is dielectric loss ? Considering the dielectric constant to be a complex quantity, derive the expression for dielectric loss. 7

- (b) A certain dielectric when subjected to an alternating field of frequency  $f_1 = 4$  GHz has a measured real part of the complex permittivity of 2.57. The tangent of the loss angle is measured to be 0.0032. Determine the power dissipated in the dielectric per unit volume if an electric field  $E = 100 \cos 2\pi f_1 t$  is applied. 7

7. Explain the following :

$$4 \times 3 \frac{1}{2} = 14$$

- (a) Diamagnetism
- (b) Paramagnetism
- (c) Ferromagnetism
- (d) Ferrimagnetism

8. Write short notes on any *two* of the following :

$$2 \times 7 = 14$$

- (a) Frohlich Theory of Breakdown of Solids
- (b) Magnetic Resonance
- (c) Hysteresis Loss