F.E.(Sem-I) CBCGS - P-I Dec-2016 /30-12-2016

Applied Physics - I

QP Code:803504

(2 Hours) [Total Marks : 60

N.B. : (1) Question. **1** is **compulsory.**
(2) Attempt any **three** questions from the remaining questions No. **2** to **6**.
(3) **Assume** suitable **data** wherever required.
(4) **Figures** to the **right** indicate **marks.**

1. Attempt any **five** questions from the following- **15**

(a) What are crystal imperfections? Mention any two significance of it.

(b) Write schrodinger's time dependent and time independent wave equations of matter waves in one dimension and state physical significance of these equations.

(c) Draw the I-V characteristics of a photo-diode. What is meant by dark current?

(d) Define super conductivity and critical temperature. Plot the variation of resistance versus temperature in case of superconducting state of the material.

(e) What is reverberation time? Discuss sabine Formula

(f) State 'magnetostriction effect.' Mention any two applications of ultrasonic waves.

(g) Calculate conductivity of a germanium sample if a donar impurity atoms are added to the extent to one part in 10^6 germenium atoms at room temperature.

Assume that only one electron of each atom takes part in conduction process.

Given: Avogadro's number- 6.023×10^{23} $^{atoms}/_{gm-mole}$

Atomic weight of Ge=72.6

Mobility of electrons = 3800 cm^2/volts sec.

Density of Ge = 5.32 gm/cm^3

2. (a) Describe with necessary theory the Davisson and Germer experiment establishing wave nature of electrons. calculate the de-broglie wavelength of an aplha particle accelerating thorugh a potential difference of 200 volts Given- Mass of alpha particle = 6.68×10^{-27}kg. **8**

(b) Define the terms drift current and mobility of a charge carriers. Calculate the current product in a germanium sample of area of cross section 1 cm^2 and thickness of 0.01 m, when a potential difference of 2 V is **7**

applied cross it. Given- The concentration of free electrons in germanium is $2 \times 10^{19}/m^3$ and mobilities of electrons and holes are 0.36 m^2/volts sec and 0.17 m^2/volts sec respectively.

3. (a) Draw and explain the unit cell of sodium chloride (NaCl) crystal. Determine effective number of NaCl molecules per unit cell and co-ordination number. **8**

(b) State applications of Hall effect. In a Hall effect experiment a potential difference of 4.5 μV is developed across a foil of zink of thickness 0.02 mm, when a current of 1.5A is carrying in a direction perpendicular to applied magnetic field of 2 tesla. Calculate **7**

(a) Hall coefficient for zinc

(b) Concentration of electrons

4. (a) Discuss formation of cooper pairs and energy gap in superconductor on the basis of BCS theory. **5**

(b) State any five factors affecting the acoustics of the building and give the remedies for each. **5**

(c) An ultrasonic pulse of 0.09 M Hz sends down towards the sea-bed which returns after 0.55 seconds. The velocity of ultrasonic waves in sea water is 1800 m/sec. Calculate the depth of sea and wavelength of ultrasonic pulse. **5**

5. (a) How does the position of Fermi energy level changes with increasing doping concentration in p-type semi-conductors? sketch the diagram. **5**

(b) Explain analysis of crystal structure using Bragg's X ray spectometer. **5**

(c) Find the minimum energy of neutron confined to a nucleus of size of the order of 10^{-14}m. **5**
Given mass of neutron = 1.675×10^{-27} kg.

6. (a) Calculate the critical radius ratio of an ionic crystal in ligancy -6. What is the maximum size of cation in ligancy-6 configuration, when size of anion is $2.02A^0$? **5**

(b) What do you mean by group and phase velocity? Show that the de-Broglie group velocity associated with the wave packet is equal to the velocity of the particle. **5**

(c) Explain the formation of potential barrier across the unbaised p-n junction region. **5**