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Second Mid-Term Examination, 2016-17
B.Tech. I-Year, I Semester
AHP-1101: Engineering Physics

Time: 1 ½ Hrs. **M. M: 20**

Note:- Answer all five questions from Section A, Any three from Section B and Any three from Section C.

Section A $1 \times 5 = 5$ Marks

I. State Ampere's circuital law.

II. Where does Fermi energy level lie in an intrinsic semiconductor?

III. Define superconductor type I.

IV. Write the relation between D, E and P applicable in dielectric solids.

V. What are the different kinds of single walled nanotube.

Section B $2 \times 3 = 6$ Marks

I. Find the electrical conductivity and resistivity of germanium doped with phosphorus atoms at room temperature with the following data: $n_e = 5x10^{22}m^{-3}$, $n_h = 2x10^{16}m^{-3}$, $\mu_e = 0.40\ m^2/(v\text{-}s)$ and $\mu_h = 0.20\ m^2/(v\text{-}s)$

II. Calculate the current produced in a small germanium plate of area $1cm^2$ and of thickness 0.5mm, when a potential difference of 2 volt is applied across the faces. Given concentration of free

electrons in germanium is $10^{19}m^{-3}$ and mobilities of electrons and holes are $0.5\ m^2/(v\text{-}s)$ and $0.2m^2/(v\text{-}s)$ respectively.

III. An electric field of 200 volt / m is applied to a sample of n-type semiconductor whose Hall coefficient is $-\ 0.01m^2coulomb^{-1}$. Calculate the current density in the sample assuming mobility of electrons equals to $0.40\ m^2\ V^{-1}s^{-1}$.

IV. A parallel plate capacitor with plate area of 4 cm^2 and plate separation of 2 mm has a voltage of 40 sin $10^3\ t$ applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$, ($\varepsilon_0 = 8.85x10^{-12}\ C^2/N\text{-}m^2$).

Section C $3 \times 3 = 9$ Marks

I. Derive an expression for the temperature dependent conductivity of an intrinsic semiconductor and show its behavior with temperature.

II. What is Hall effect? Find the expression of Hall coefficient and give the significance of this measurement.

III. Write the Maxwell's equations with their physical significances and derive the Maxwell's fourth equation based on Ampere's modified law valid for time varying currents.

IV. What does Poynting vector signify? Deduce the Poynting theorem for the flow of energy in electromagnetic field.