JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-1 EXAMINATION -October 2018 Dr. S. K. Tiwari

Ph.D 1st Semester (PMS)

COURSE CODE: 18P1WPH111 MAX. MARKS: 25

COURSE NAME: COMPOUND SEMICONDUCTORS

COURSE CREDITS: 03 MAX. TIME: 1 Hr 30 Mins

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

Que 1. Suppose there is no charge and current in particular region of space . **[2+3+1=6]**

(a) Write all Maxwells's equations.

(b) Show that $\nabla^2(E,B) = \mu_0\epsilon_0 \frac{\partial^2(E,B)}{\partial t^2}$ also give tentative solution of this equations.

Que 2. What happens when a wave passes from one transparent medium to other, like air to water or glasses to plastic? Write electro-dynamical boundary conditions. **[2+2=4]**

Que 3. A plane wave of frequency ω traveling in z direction and polarized in the x direction approaches to the interface from left to right. Show that Reflection coefficient (R) and Transmission coefficient (T) is given as $R= \left(\frac{n_1-n_2}{n_1+n_2}\right)^2$ and $T= \frac{4n_1n_2}{(n_1+n_2)^2}$, where n_1 and n_2 are refractive index of medium one and two respectively , $n_1>n_2$. **[5]**

Que 4.

(a) An electromagnetic wave travel through a conductor which have free charge density ρ_f and current density J_f. For this propagation show that wave number (K) is complex, also give origin of skin depth or penetration depth.

(b) In contrast to case (a), now suppose that same electromagnetic wave is incident/propagate through an insulator. Derive the expression for total polarization. **[5+5=10]**

Hint: (a) for question no 3 consider the electromagnetic wave as follows

$E_{I,R,T} = E_{0,I,R,T} e^{i(k_{1,2}z - \omega t)}$ $B_{I,R,T} = \pm \frac{1}{v_{1,2}} E_{0,I,R,T} e^{i(k_{1,2}z - \omega t)}$

(b) For question 4 b, Insulating medium can visualized as electron bound to nucleus like a spring system, with force constant k.