Tutorial 5, Physics-2 (15B11PH211), 2022

1. A beam of light traveling through air falls normally on glass surface having refractive index = (4/3). Calculate reflectivity and transmissivity. Also, show that their sum is unity. [C02]
2. Traveling **E** and **H** waves in free space (region 1) are normally incident on the interface with a perfect dielectric (region 2) for which ε_r=4.0. Compare the magnitudes of the incident, reflected and transmitted **E** and **H** waves at the interface. [C02]

3. A 10Hz plane wave is propagating in a large block of material having ε_r = 4.0. The amplitude of the electric field is 20 mV/m. Find (a) the velocity of propagation, (b) the wavelength and (c) the amplitude of B. [C02]

4. Consider a linearly polarized electromagnetic wave (with its electric field vector along x-direction) of magnitude 500 V/m propagating in vacuum. It is incident on a dielectric interface at y = 0 at an angle of incidence of 30 degrees. The frequency associated with the wave is 1000Hz and the refractive index of the dielectric is 1.5. Show that R+ T=1. [C04]

5. If in question 4, the magnetic field vector was in x direction and the electric field vector was in the y-z plane. If the angle incidence and rest of the parameters remain the same, will the value of R, T and R+T change. [C03]

6. Determine the amplitude of reflected and transmitted E at the interface of two regions. The characteristics of region 1 are ϵ_{r1}=8 and μ_{r1}=2. The second region is vacuum. Assume normal incidence, and that the amplitude of the incident electric field is 10V/m. [C03]

7. The electric and magnetic field vectors of incident EM wave are given by the following equations: $\mathbf{E_I} = E_{IO} \exp i(k_I y - wt)\mathbf{k}$ and $B_I = (E_{IO}/V_I) \exp i(k_I y - wt)\,\mathbf{i}$ where V_I, k_I, represent the velocity and propagation constant of the incident wave. Write the general expression for electric and magnetic field vectors of reflected and transmitted waves (interface is at y= 0). [C01]