

EE 301(B) Tutorial 5

1. A uniform plane wave travelling (With $|E| = 10^{-3}$ V/m) in free space is incident on a semi-infinite lossless medium with a dielectric constant of 1.44. Determine the values of the reflection coefficient, transmission coefficient, incident and transmitted power, and travelling wave and standing wave parts in the incident medium.
2. Region 1, $z < 0$, and region 2, $z > 0$, are both perfect dielectrics ($\mu = \mu_0$, ϵ and loss less). A uniform plane wave traveling in the a_z direction has a radian frequency of 3×10^{10} rad/s. Its wavelengths in the two regions are $\lambda_1 = 5$ cm and $\lambda_2 = 3$ cm. What percentage of the energy incident on the boundary is (a) reflected; (b) transmitted?
3. Consider a parallel polarized electromagnetic wave radiated from a submerged submarine impinges on a water-air interface. Assuming the zero conductivity for water and $\epsilon_r = 81$. Calculate (a) the value of the incidence angle for which reflected power is zero. (b) Repeat the above problem considering the wave radiated from an aircraft impinges on an air-water interface. Also, assume that the conductivity of air is zero.
4. A perpendicularly polarized plane wave at 100 GHz impinges on a flat metallic reflector at an angle of incidence α . The incident electric field intensity is in the positive x direction, has amplitude 100 V/m, and propagates in free space. Assume the incident magnetic field intensity has components in the positive y and negative z directions and that the interface coincides with the x-y plane. Calculate: The surface current density as a function of the incidence angle α on the surface of the conductor. Plot its magnitude and show for what values of the incidence angle the current density is maximum and for what values it is minimum.
5. A plane electromagnetic wave is incident on the surface of a dielectric-air interface at 62° with dielectric while travelling from dielectric to air. Calculate the permittivity of the dielectric if at this angle there is no transmission from the surface.
6. A circularly polarized plane wave is incident on a thick glass slab at an angle of incidence 45° . Find the state of polarization of the reflected and transmitted waves. The frequency of the wave is 10^{14} Hz and the refractive index of glass is 1.5.