EE 434 Electricity and Magnetism, Spring 2009
Homework #7 Assignment

(a) A wave in medium 1 is traveling normally incident toward the interface with medium 2. If $\epsilon_{1r} = 1$, $\epsilon_{2r} = 5$, and the materials are non-magnetic and non-conducting, what is the reflection coefficient for the fields?
(b) In the same case, what is the reflection coefficient for the wave power ($\mathrm{W/m^2}$)?
(c) A wave of frequency 100 MHz and electric field amplitude 5 V/m is traveling in air is normally incident onto a perfect conductor. Compute the electric field amplitude 1, 2, and 3 m from the surface of the conductor.
(d) Compute the magnetic field amplitude at the same distances.
(e) Explain the function of a quarter-wave plate.
(f) Design a quarter wave plate separating two media, $\epsilon_{1r} = 1.5$, and $\epsilon_{2r} = 5$ (and non-magnetic, non-conducting). $f = 100\,\mathrm{MHz}$.
(g) Explain the function and purpose of a half-wave plate.
(h) Design a half-wave plate separationg two region of $\epsilon_{1r} = 2$, $\epsilon_{2r} = 2$. $f = 10\,\mathrm{GHz}$.
(i) Consider three regions, $\eta_1 = 100\,\Omega$, $\eta_2 = 50\,\Omega$, and $\eta_3 = 20\,\Omega$, with wave incident in region 1. Region 2 has a thickness of $d_2 = 0.8\lambda_2$. Use a Smith chart to determine the reflection coefficient in region 1.
(j) What is the brewster angle for the air/glass interface? The glass is non-magnetic and has a index of refraction of $n = 1.6$.
(k) For the same glass, compute the transmission angle for 45° degree incidence angle.
(l) Still for the same case, assume the incident wave has amplitude 5 V/m, compute the amplitude of the reflected and transmitted wave, for both the perpendicular and the parallel case.