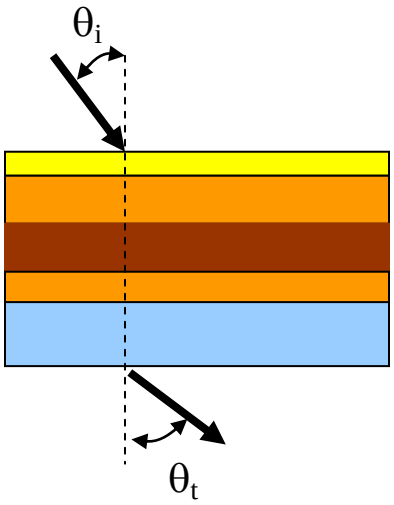
Homework 2:

1. You have two waves of the same frequency and polarization but propagating at and angle to each other $E_1 \cos(\mathbf{k}_1 \cdot \mathbf{r} - \omega t)$ and $E_2 \cos(\mathbf{k}_2 \cdot \mathbf{r} - \omega t)$. What is the Poynting vector direction and magnitude? Consider first general case, then specifically the case of equal amplitudes and arbitrary angle, and finally the case of equal amplitudes and opposite directions.

2. Consider a stack of 5 dielectric layers with different indices of refraction and thicknesses. The light is incident on the stack from the air at an angle θ_i.



a. What is the transmission angle θ_t?
b. Will there be a total internal reflection somewhere inside the stack? If the answer is "Yes" at what angle?
c. Can you find an angle at which 100% transmission can be achieved for one of polarizations?

3. Consider the total internal refection from the medium whose refractive index has a small complex part $n_2 = n_2^{'} + j\kappa_2 \quad n_2^{'} > n_1$. Does the power flow in the direction normal to the interface?

4. Consider the medium with the following dispersion law $\omega^2 = \omega_0^2 + k^2 c^2$. Evaluate the phase and group velocities and compare them to the speed of light in vacuum.