Physics 8110 - Electromagnetic Theory II

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Assignment #4

(due to Monday, March 19, 2018)

1. The electric field for an elliptically polarized plane wave is $\mathbf{E}=\mathbf{E}_1+\mathbf{E}_2$, where $E_1 = \hat{e}_x \cdot E_1\, e^{i\cdot(k\cdot z-\omega\cdot t+\alpha)}$ and $E_2 = \hat{e}_y \cdot E_2\, e^{i\cdot(k\cdot z-\omega\cdot t+\beta)}$. Calculate the average energy flow for such a wave.
   (a) Does the energy flow depend on the phases α and β? Assume that E_1 and E_2 are real quantities.
   (b) Determine the polarization state of $\mathbf{E}=\mathbf{E}_1+\mathbf{E}_2$!
   (15points)

2. A linearly polarized wave $E_x = E_o\, e^{i\cdot(k\cdot z-\omega\cdot t)}$ is normally incident onto a dielectric medium. The medium has indices of refraction n_1 and n_2 for left-circularly and right-circularly polarized light, respectively. Find the reflection coefficient *R*.
   (15points)

3. Problem 7.4, Jackson textbook.
   (30points)

4. An unpolarized light is incident upon a dielectric interface at Brewster's angle. Find the ratio of the transmission coefficient T_1/T_2, and show that this ratio is greater than unity for *n* not equal to *n'*.
   (20points)

5. A thin dielectric film of thickness ***d*** and the dielectric function ε_1 (ε_1 real) lies between media of dielectric functions ε_0 and ε_2. A light wave of frequency ω is incident normally from ε_0. Calculate the reflection coefficient *R*.
   If $\varepsilon_0 = \varepsilon_2 = 1$, simplify *R* and find the conditions for minimum and maximum reflections as function of film thickness, assuming a fixed wavelength λ.
   (20points)