Physics 422 - Spring 2013 - Assignment #6, Due April 14th

1. (*Hecht, 8.16*) Two ideal linear sheet polarizers are arranged with respect to the vertical with their transmission axis at 10° and 60°, respectively. If a linearly polarized beam of light with its electric field at 40° enters the first polarizer, what fraction of its irradiance will emerge?

2. (*Hecht, 8.32*) A beam of natural light is incident on an air-glass interface ($n_{ti} = 1.5$) at 40°. Compute the degree of polarization of the reflected light.

3. (*Hecht, 8.56*) Show by direct calculation, using Mueller matrices, that a unit-irradiance beam of natural light passing through a linear polarizer with its transmission axis at +45° is converted into a $\mathcal{P}$-state at +45°. Determine its relative irradiance and degree of polarization.

4. (*Hecht, 8.58*) **(a)** Confirm that thte matrix

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$$

will serve as a Mueller matrix for a quarter-wave plate with its fast axis at +45°.
(b) What happens when light that is linearly polarized at 45° shines through it?
(c) What emerges when a horizontal $\mathcal{P}$-state enters the device?

5. (*Hecht, 8.72*) A liquid cell containing an optically active sugar solution has a Jones matrix given by

$$\frac{1}{2\sqrt{2}} \begin{bmatrix} 1+\sqrt{3} & -1+\sqrt{3} \\ 1-\sqrt{3} & 1+\sqrt{3} \end{bmatrix}$$

(a) Determine the polarization of the emerging light if the incident beam is a horizaontal $\mathcal{P}$-state.
(b) Determine the polarization of the emerging light if the incident beam is a vertical $\mathcal{P}$-state.
(c) Determine the angle of rotation produced by the optically active material.