PHYS3038 Fall 2015
Homework #6
Due date: 27 Oct 2015

Problems:

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?

8.21 An ideal polarizer is rotated at a rate ω between a similar pair of stationary crossed polarizers. Show that the emergent flux density will be modulated at four times the rotational frequency. In other words, show that

$$I = \frac{I_1}{8}(1 - \cos 4\omega t)$$

8.37 The electric-field vector of an incident $\mathscr{P}$-state makes an angle of $+30°$ with the horizontal fast axis of a quarter-wave plate. Describe, in detail, the state of polarization of the emergent wave.

8.42* Suppose you were given a linear polarizer and a quarter-wave plate. How could you determine which was which, assuming you also had a source of natural light?

8.53 Find a Jones vector $\tilde{\mathbf{E}}_2$ representing a polarization state orthogonal to

$$\tilde{\mathbf{E}}_1 = \begin{bmatrix} 1 \\ -2i \end{bmatrix}$$

8.72* A liquid cell containing an optically active sugar solution has a Jones matix 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 horizontal $\mathscr{P}$-state.

(b) Determine the polarization of the emerging light if the incident beam is a vertical $\mathscr{P}$-state.

(c) Determine the angle of rotation produced by the optically active material.