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 \(P\)-state at +45°. Determine its relative irradiance and degree of polarization.

4. *(Hecht, 8.58)* (a) Confirm that the 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 \(P\)-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 horizontal \(P\)-state.

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

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