

Physics of Waves

PH11003

Tutorial 10 Problems

Topic : Polarization

28 January 2023

[10.1] Describe the polarization of the following wave and write an expression for its magnetic field.

$$\vec{E} = E_0(\hat{x} + i\hat{y})e^{i(kz - \omega t)}$$

[10.2] The degree of polarization of partially polarized light is $P = 0.25$. Find the ratio of intensities of the polarized component of this light and the natural component.

[10.3] Initially unpolarized light passes in turn through three linear polarizers with transmission axes at 0° , 30° , and 60° , respectively, relative to the horizontal. What is the intensity of the product light, expressed as a percentage of the unpolarized light intensity?

[10.4] An ideal polarizer is rotated at a rate ω between 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

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

where I_1 is the flux density emerging from the first polarizer and I is the final flux density.

[10.5] How thick should a half-wave plate of mica be in an application where laser light of 632.8 nm is being used? Appropriate refractive indices for mica are 1.599 and 1.594.

[10.6] At what angles will light, externally and internally reflected from a diamond-air interface, be completely linearly polarized? For diamond, $n = 2.42$.