

OPTICS, 114210 - Homework Exercises

C. Electromagnetic wave propagation.

1. A beam-splitter is made using one surface of a glass plate of refractive index n , for which the amplitude reflection and transmission are given by the Fresnel coefficients (look these up in a text-book).
 - (a) Show that, at any angle of incidence, the reflection coefficients from the opposite sides R_1 and R_2 satisfy $R_1 = -R_2$.
 - (b) At an angle of incidence of 45° from the air side, what is the ratio between the reflection coefficients for the two principle polarized components?
 - (c) At what angle is the reflected light completely polarized?
2. The plane surface of a plate of glass of refractive index n is coated with a thin film of transparent material, refractive index \sqrt{n} . For what film thickness is the reflection coefficient equal to zero for normal incidence?
3. The refractive index of a medium for X-rays is given by $n = (1 - \Omega^2 / \omega^2)^{\frac{1}{2}}$, where Ω is the "plasma frequency" and ω the wave frequency. Show that the product of wave and group velocities is c^2 .
4. A material has complex refractive index $n = n_r + i n_i$. What thickness of material, in free-space wavelengths, will absorb 50% of the light entering it? (ignore surface reflections).