

Assignment 05: Chapter 04

DUE: February 22, 2008

Spring 2008

Work each problem neatly and completely. Each problem is worth **5 points**. You should solve on green engineering paper or blank unruled paper. You must include sufficient demonstration of your problem solving process. If a problem is to be solved by inspection, state this. If graphs or plots are required, you should use an appropriate tool for their construction (there are several respectable options available on the computers in LSC 114).

1. Hecht, problem 4.25
2. Find the values for r_{\perp} , t_{\perp} , r_{\parallel} , and t_{\parallel} for normal incidence when the incident medium is water ($n_i = 1.33$) and the transmitting medium is glass ($n_t = 1.55$). Repeat if glass is the incident medium and water is the transmitting medium.
3. Light in air ($n_i = 1$) is incident on a piece of glass ($n_t = 1.50$) at an angle of 55° . For the reflected light, calculate the phase shift

difference $\Delta\phi = \phi_{\parallel} - \phi_{\perp}$ for E_{\parallel} and E_{\perp} .

4. A slab of glass ($n = 1.52$) is immersed in water ($n = 1.33$).
 - A) For total internal reflection to occur, which medium must be the incident medium, which the transmitting medium? Sketch the situation.
 - B) Find the critical angle θ_c for total internal reflection.
 - C) Determine the reflectance R for normal incidence when the glass is the incident medium.
 - D) Find R and T for an angle of incidence $\theta_i = 20^\circ$ when water is incident and glass is transmitting medium.

Review Questions

These are not assigned for grading, but they are the sort of conceptual questions that you should be able to address adequately if they were to show up on an exam.

1. Why are metals typically highly reflective? Why do many metals appear grayish (steel, aluminum, titanium, etc.)?
2. If gold is opaque, why did Neil and Buzz have gold-coated space visors (p 130)?
3. If a pane of glass is transparent, why does ground glass appear white?

