Phys 3330 Electricity & Magnetism II
Spring 2017
Assignment #8 - due Wednesday April 19th 2017

Reflection at a boundary

1. In class we derived the reflection and transmission coefficients for light falling on a boundary at normal incidence. Define the intensity reflection coefficient as $R = \langle S_r \rangle / \langle S_i \rangle$ and the intensity transmission coefficient as $T = \langle S_t \rangle / \langle S_i \rangle$. Show that energy is conserved, that is $R + T = 1$.

2. We also derived the reflection and transmission coefficients for light falling on the boundary at an angle of incidence θ_i, if the electric field vector lies in the plane of incidence. Show that energy is still conserved providing R and T are defined in terms of the components of the Poynting vector *perpendicular to the surface*, that is $\langle S \rangle_z$.

3. A wire of length L and radius R is made from a conductor with a resistivity ρ (= σ, where σ is the conductivity). It carries a current I.
   a. What is the electric field inside the wire? (Assume that both the electric field and the current density are uniform across the wire.)
   b. Write down the magnetic field at the surface of the wire. (You can get this from your General Physics text book, or from chapter 5 in the text book for this class.)
   c. Calculate the Poynting vector at the surface of the wire.
   d. Calculate the total radiated power.
   e. Do you recognize this?