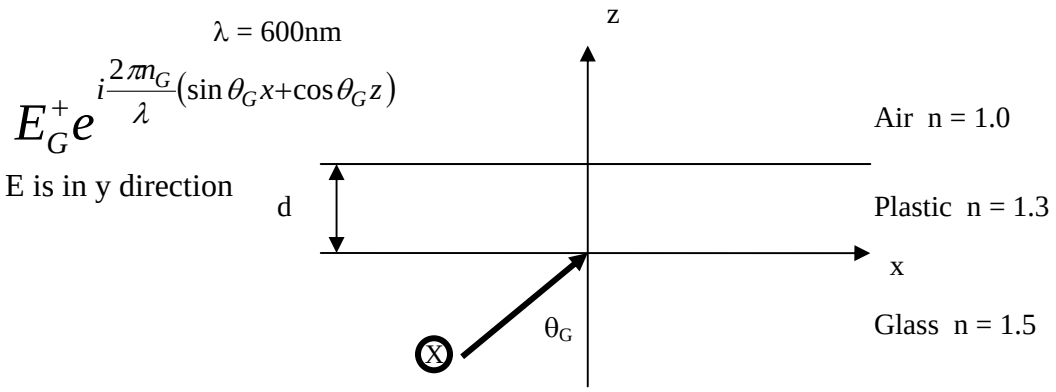
Version 10/5/06

EECS 210 Applied Electromagnetic Theory

Fall 2006 | **Office Hours** | **Prof. A. R. Neureuther,**
Tu, Th 12:30-2 | **M, (W), 11AM** | **509 Cory Hall, 2-4590**
400 Cory | **Tu, Th, (F) 10AM** | **neureuth@eecs**

Homework # 6: Due Sart of Class Thursday, Oct 19th
Midterm In Class Tuesday, Oct 24
See Exam Midterm Specification Sheet



6.1) **Kinetic Boundary Conditions and k-vectors:**
a) Start a k-vector plot by drawing the k_x and k_z axes and concentric circles of radius 1, 1.3 and 1.5. (The 1 here indicates that the k-vectors are normalized to the k for a plane wave in free space.)
b) Sketch the 5 k-vectors for the plane waves that will arise for an incidence angle of 30^o in glass.
c) Compute the angles in plastic and air and show that the k-vector x-component is the same for all 5 k-vectors.
d) Find the period of the variation parallel to the surface. (It is larger than 600 nm and this allows radiation in air).
e) Find the k-vectors for an incidence angle of 60^o in glass find the period of variation along the surface. (It is smaller than 600nm and no radiation occurs.)
6.2) **Dynamic Boundary Conditions:**
a) Write out phasor expressions for the plane wave fields as a function of x and z for each of the 5 k-vectors in terms of a complex constant in each region using the example notation above.
b) Write sufficient boundary conditions at z = 0, plug in the fields and evaluate derivatives.
c) Write sufficient boundary conditions at z = d, plug in the field and evaluate derivatives.
d) Show that the kinematic condition can be factored out of these boundary conditions.
6.3) **Physical Effects:**
a) Find the time-average and instantaneous Poynting vector in air for 30^o incidence in glass.
b) Find the time-average and instantaneous Poynting vector in air for 50^o incidence in glass.
c) Show that for 50^o incidence in glass that the z-component of the Poynting vector is zero for time average and imaginary for time-varying.
d) Define the transverse impedance as E_y/H_x and show that this impedance is real for 30^o incidence in glass and becomes a capacitive reactance for 50^o incidence in glass.
e) Show that the ratio of the incident and reflected waves in plastic at d is independent of d itself and hence the standing wave ratio in plastic does not depend on thickness.