EE 117 Spring 2002
Midterm II

Closed book, one page of notes
All questions are of equal credit

Problem 1
Suppose you have a device which puts out 200 watts of RF power at a gigahertz, with an output impedance of 50 ohms, and 10 meters away you have a load, which looks like a 200 ohm resistor in parallel with 10 pf of capacitance. Also suppose that you can build coaxial transmission lines with whatever dimensions you want, with a relative dielectric constant of 2.

a) Design a system to get substantially all the RF power into the load. Give the dimensions of the coax that you would use, and the lengths of each of the segments that you use in your design.

Problem 2
A 50 ohm transmission line which is used for 1 volt logic pulses is terminated by a 50 ohm resistor parallel with the input of an amplifier which has a 2 picofarad capacitance.

a) Sketch the load voltage and reflected voltage waveforms for an incident 1 nanosecond long pulse.

b) Find a differential equation for the voltage across the load as a function of the input voltage waveform.

Problem 3
A plane wave is incident on a dielectric $epsilon_r = 2$ at an angle of 45 degrees from the normal. Taking the incident ray to be in the x-z plane, the light is polarized with the E field $E = E_0 e^{j(k \cdot r - \omega t)}$
*note: E, E_0, k and r are vectors, NOT scalars.

a) Find the allowed direction of the vector constant E_0.

b) Find the direction of E_0 for the TE and TM polarizations.

c) For a TE field, find the total reflected power off the interface.