NAME: _____

ELEE 6340
Fall 1998

EXAM I

INSTRUCTIONS:

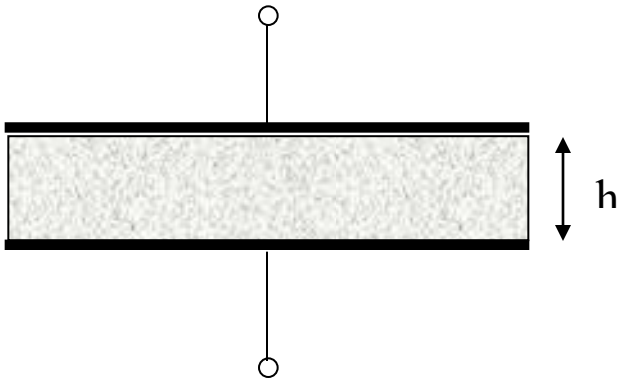
This exam is open-book and open-notes. You may use any material or calculator that you wish. Please show all of your work and write neatly in order to receive credit. Put all of your answers in terms of the parameters given in the problems, unless otherwise noted. All problems are worth equal credit.

Prob. 1

A parallel-plate capacitor if filled with a lossy material, as shown below. Assume that the material has a constant value of conductivity σ (not frequency dependent) and also a constant value of permittivity $\hat{\varepsilon}$ (which is complex, but not frequency dependent).

The input impedance at 10 MHz is 324.575 – j(29.5463) Ω, and the input impedance at 100 MHz is 174.4619 – j(136.4551)Ω. From this information, determine both $\hat{\varepsilon}_r$ (complex) and σ.

Assume that the area of each plate is 0.001 m^2, and that the plate separate *h* is 0.01 m.

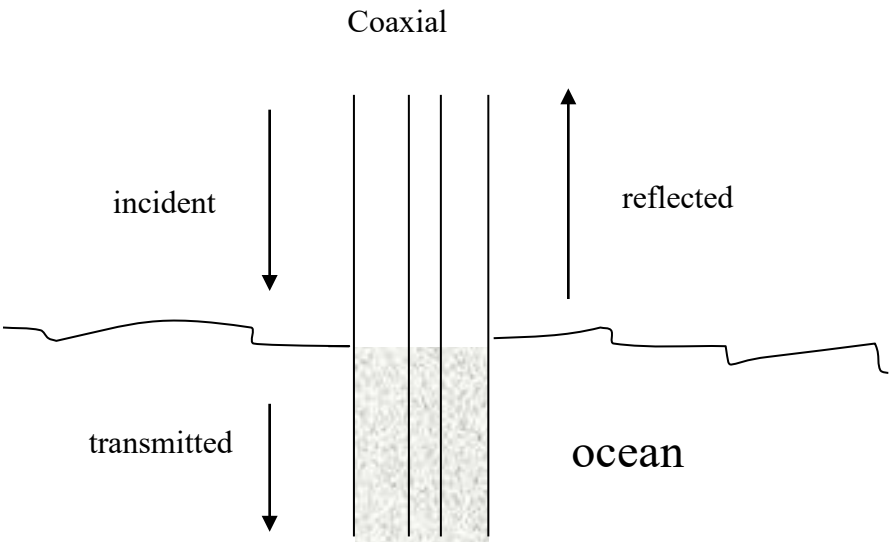


(space for work)

Prob. 2

A coaxial transmission line extends from the air region into the ocean as shown below. Above the surface of the ocean the coaxial line is filled with air. Below the surface of the ocean the line is filled with seawater (nonmagnetic), which has $\hat{\varepsilon}_r = 81$ (a real number) and $\sigma = 4$ S/m. Assuming that a signal is incident from the air region, determine the percent power that is reflected and the percent power that is transmitted into the ocean.

The inner radius of the coax is a = 0.1 cm, the outer radius is 0.25 cm, and the frequency is 1.0 GHz. Assume that the metal conductors are perfectly conducting.



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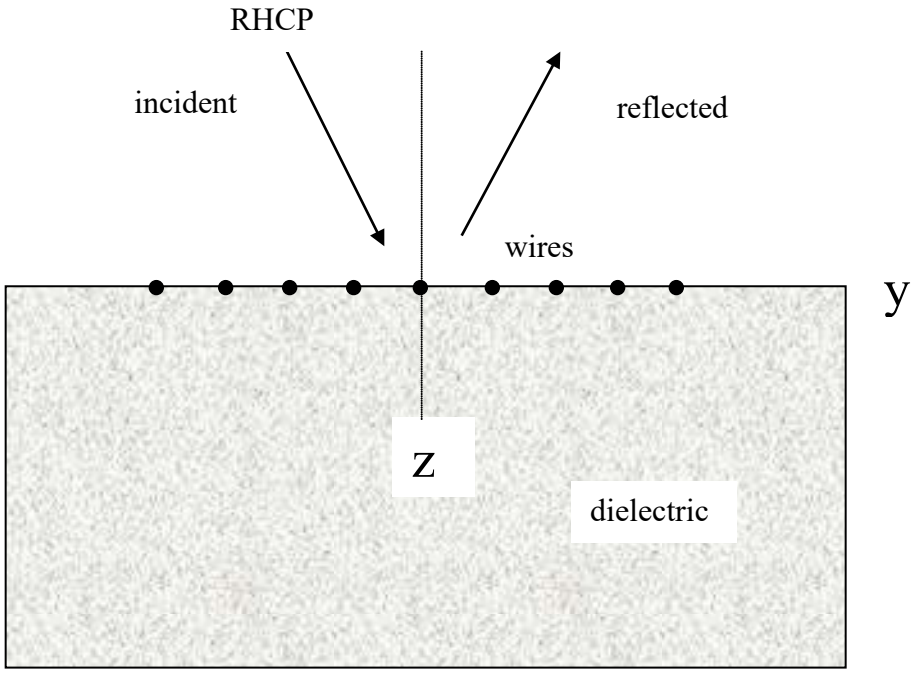
Prob. 3

An RHCP wave is incident on a dielectric half-space of material as shown below. At the interface there are a number of closely spaced perfectly conducting wires, running parallel to the *x* axis. These wires create a perfectly reflecting surface for a TE polarized plane wave, while the wires are transparent for a TM polarized plane wave. That is, a TE plane wave sees a perfectly conducting surface at *z=0*, while a TM wave sees only a dielectric interface.

Assume that the incident angle is $\theta = 30^0$ and that the dielectric half-space is lossless and nonmagnetic, with $\varepsilon_r = 2.2$.

a) Determine the percent power reflected.

b) Determine the axial ratio of the reflected wave.



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