MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.014 Electrodynamics

	Issued:	April 18, 2002
Problem Set 10	Due in **Lecture**:	April 25, 2002

Suggested Reading: Text: Sections 8.5 and 7.1.

Note: ***Quiz 2 will be held during lecture on April 23; it emphasizes material covered 3/10 – 4/14 (Problem Sets 6 – 9). Selected equations will be provided (as was done for Quiz 1).***

Problem 10.1

A lossless air-filled 100-ohm TEM line one meter long is open-circuited at both ends.

a) What are its resonant frequencies f_n (Hz)?

b) If one microjoule is stored in this resonator at any non-zero resonant frequency, what is the peak voltage v(z,t) across the line?

c) If a 10-kΩ resistor is placed across one end of the line at the lowest non-zero resonant frequency, what is the Q of this resonator?

Problem 10.2

A parallel-plate wavequide has a plate separation of one centimeter and is filled with dielectric having $\varepsilon = 4\varepsilon_o$.

a) What are the cut-off frequencies f_{co} for the TM_1, TM_2, and TE_2 modes?

b) What is the waveguide wavelength λ_g of the TM_1 mode at twice its cutoff frequency?

c) For the wave of part (b), what is the group velocity of that wave?