MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Experimental Study Group

Physics 8.022, Spring 2011

Problem Set 10
RLC circuits, AC circuits

Due: Wednesday, April 27th, 10 pm

Problem 1: Problem 1 Purcell 7.17

Extra question — By grounding this circuit, we make the switch safer to operate. Describe why a large spark jumps across the switch when it is not grounded, and why the spark does not happen when it is grounded.

Problem 2: Problem 2 Purcell 8.4

Problem 3: Problem 3 Purcell 8.7

A resonant cavity of the form illustrated is an essential part of many microwave oscillators. It can be regarded as a simple LC circuit. The inductance is that of a toroid with one turn. Find an expression for the resonant frequency of this circuit and show by a sketch the configuration of the magnetic and electric fields.
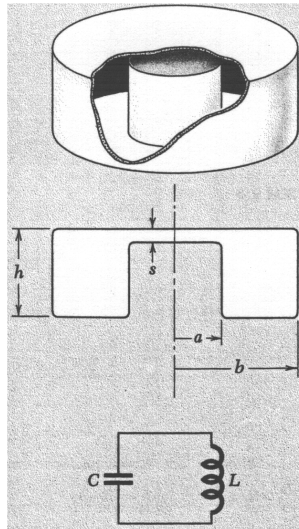

Figure 1: Purcell 8.7

Problem 4: Problem 4 Purcell 8.9

Problem 5: Problem 5 Purcell 8.12

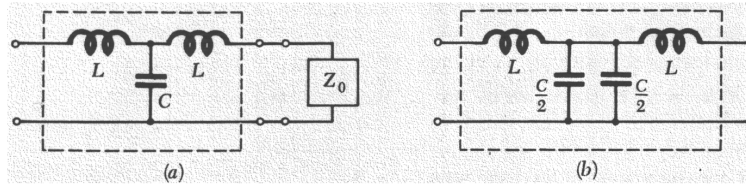## Problem 6: Problem 6 Purcell 8.16

Figure 2: Purcell 8.16

An impedance Z_o is to be connected to the terminals on the right. For given frequency ω find the value which Z_o must have if the resulting impedance between the left terminals is Z_o. The required Z_o is a pure resistance R_o provided $\omega^2 < 2/LC$. What is Z_o in the special case $\omega = \sqrt{2/LC}$?

Problem 7: Problem 7 – Optional Purcell 8.10

Problem 8: Problem 8 – Optional Purcell 8.13

Problem 9: Problem 9 – Optional Purcell 8.14