PS 7 Physics 201 February 24, 2010 R.Shankar Due March 3.

1. In an LCR circuit we know the current has a maximum at $\omega = \omega_0 = \sqrt{\frac{1}{LC}}$. Show that the current falls to $1/\sqrt{2}$ of the maximum if we go off ω_0 by $\delta = R/2L$ provided $\delta/\omega_0 << 1$.

2. Find the impedance of the circuit with L, C and R in parallel.

3. Consider a circuit element which is made of a C in parallel with an $R + L$ in series as shown in Fig.1. Are there any ω's for which its impedance is real? If yes, at what ω?

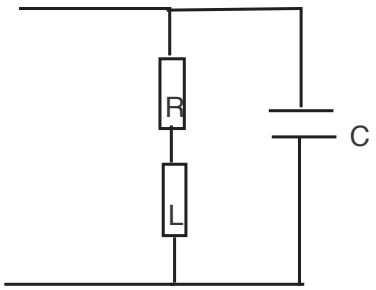

Figure 1: Can the impedance of this circuit be real? If so at what frequency?

4. You are given voltage source at $\omega = 2000$ and a box that contains: $R_1 = 100\Omega, R_2 = 200\Omega$, $C_1 = 1\mu F, C_2 = 100\mu F$, and $L_1 = 1mH, L_2 = 2mH$. What will you pick if, using one resistor, one capacitor and one inductor in series you need to make a circuit with the smallest and largest $|Z|$? Give the values of $|Z|$ in both cases.

5. An AC source $30\cos 500t$ is connected to two impedances in series. The first is a resistor, $Z_1 = 10\Omega$ and the second, Z_2, is made of a 15Ω resistor in series with a $2\mu F$ capacitor. What is the power loss in across Z_2?

6. I apply a voltage $V(t) = 200\cos 200\pi t$ to a capacitor with two concentric circular plates of radius $4cm$ spaced $2cm$ apart in the z-direction, with the upper plate positive at $t = 0$. Assuming the $\mathbf{E}$ field is restricted to the plates, find the B field at a distance r from the center and half-way between the plates for all r. Evaluate its maximum amplitude in Tesla.