Homework #4

due Thursday February 22

1. *Visualizing forced resonances.* Go to the website http://mysite.verizon.net/vzeoacw1/impedance.html on a java enabled computer. There is a java applet at the bottom of the page. (a) Click on Imax(f) in the bottom right hand corner of the applet, and it will plot the maximum current as a function of frequency. Try sliding the value of the resistance up and down. How does the appearance of the resonance peak change as the resistance changes? Explain why, for low values of the resistance, there is a sharp peak at the resonant frequency. (b) Set the value of the resistance to 15 Ω, the capacitance to about 255 nF, and the inductance to about 2000 μH, and sketch the peak. Remember to put numerical values on the axes. Click on Z(f) on the lower right and draw the capacitive reactance, the inductive reactance, and the total impedance as a function of frequency. (c) Now set the slider for the frequency to about 5 kHz and sketch $\phi(f)$ and $i(t), V(t)$. Do the same for the resonant frequency and for 15 kHz.

2. Hirose and Lonngren, Chapter 2 #1

3. The left hand end of a horizontal stretched string is oscillating transversely with SHM. The tension in the string is 140 N, the density of the string is 0.12 kg/m, the amplitude is 2.6 cm, and the frequency is 250 Hz. At a time t=0, the string is rising with a displacement of 1.6 cm. Determine: (a) the wavelength, and (b) the equation of the traveling wave. (c) How would the equation differ if it were the right hand of the string oscillating instead of the left?

4. Hirose and Lonngren, Chapter 2 #4

5. Hirose and Lonngren, Chapter 2 #7

6. Show explicitly that the following functions satisfy the wave equation: (a) $y(x,t) = k(x+vt)^3$; (b) $y(x,t) = Ae^{ik(x-vt)}$; and (c) $y(x,t) = \ln k(x-vt)$, where A and k are constants.

7. Hirose and Lonngren, Chapter 2 #9