**DAY 21 – Homework**

1. Give an equation for the natural frequency of the lightly damped electrical oscillator. The equation should give $f_0$ in terms of L & C.

2. If an electrical oscillator has L = 5 mH and C = 0.01 F, what resistance is required for the oscillator to be critically damped?

3. Suppose a rod antenna 2 m long develops an alternating voltage on it with amplitude 20 mV. What is the amplitude of the E-field component of an EM wave being picked up by the antenna?

4. Calculate the range of wavelengths in the AM and FM bands of the radio dial. (You'll need to look at a radio for this one.)

5. Many TV's still come with a set of "rabbit ears" – an antenna for those people who don't have cable. Most people throw these away, but they do work! You can watch broadcast TV for free, just like listening to the radio!!! Really!

http://www.autotoys.com/pics/thumbs/t_TV3.jpg

The rod "dipole" part works for VHF stations (broadcast channels 1-13, including WAVE-3 and WHAS-11 in Louisville), and the loop works for UHF stations (broadcast channels 14 and up, including WLKY-32, FOX-41, UPN's Big58, and the KET broadcast stations). Explain how the VHF antenna of a TV set works. Explain how the loop UHF antenna of a TV set works. Explain why the voltage induced in a UHF antenna depends on the frequency of the signal, whereas the voltage in a VHF antenna does not.

6. The tuning circuit in a receiver has a fixed capacitance of 5.0 nF (nano-Farad) and a variable inductance. What inductance is needed if the receiver is to resonate with waves from WHAS (840 kHz)? If the receiver is to cover the entire AM dial, what range of inductances must the inductor be able to vary over?

7. EM waves of visible light have wavelengths ranging from $\lambda$ = 700 nm for red light to $\lambda$ = 400 nm for violet light. What frequencies are these waves?

8. **PHY 232 Only**
   A loop antenna measures 1 m in diameter and consists of 10 loops of wire. Calculate the amplitude of voltage induced in the antenna if placed in an EM wave with B-field amplitude 5 mT and frequency 100 MHz.