HOMEWORK FOR LAB 6: INTRODUCTION TO INDUCTORS AND LR CIRCUITS

1. Describe concisely a procedure one could use to induce a voltage across a coil using only a permanent magnet.

2. Describe concisely a procedure one could use to induce a voltage across a coil using only a second coil of wire, a battery and a switch.

3. Draw a diagram showing the magnetic field around a current carrying coil of wire. Clearly show the direction and relative magnitude at several places around the coil.

4. You are asked to design an inductor of value 0.5 H. What would be the specifications of your inductor? Specify number of turns, cross sectional area, and length of the coil and make your reasoning clear. (Hint: there are a large number of sets of answers you may choose for this design. Make it something you can handle!)
5. Suppose the inductor you designed for problem 4 is constructed of copper wire of cross-sectional area $4 \times 10^{-7} \text{ m}^2$ and resistivity $7 \times 10^{-7} \text{ } \Omega \text{-m}$. What is the resistance of the inductor you designed?

6. What is the time constant of a circuit made of a real inductor ($L=0.2 \text{H}$, $R=75 \Omega$) and resistor ($R=225 \Omega$)?

7. You are asked to design an RL Circuit with time constant 0.00025 sec and are given an inductor of value $0.03 \text{ H}$ with 12 $\Omega$ of resistance. What value resistor should you choose for the circuit?

8. The circuit in question 7 is connected to a 12-volt battery. When the switch in this circuit is closed (so that the LR circuit with the battery is a closed loop), what will be the current though the circuit after 0.00025 sec (1 time constant)?

9. What will be the current through the circuit in (8) after .0005 sec (2 time constants)?