PHY222 **RL Circuits**

Objectives

After completing this laboratory, a student will be able to:

1. determine the time constant of a RL circuit.
2. determine the inductance of an unknown inductor in an RL circuit
3. determine the resistance of an unknown resistor in an RL circuit

Procedure for Part 1: RC Circuit

1. Set up the circuit that is shown in Figure 3. Be sure that channel 1 and 2 are hooked up at the proper spots.

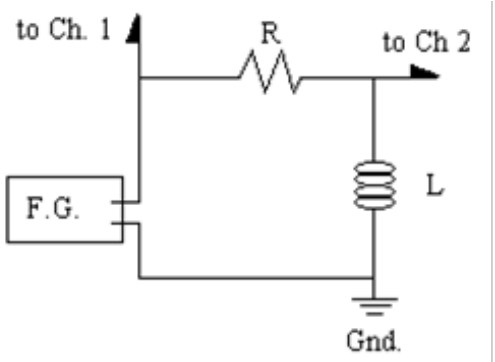

Figure 3

   Exact setup procedure:
   - From red FG plug CH1 red oscope plug
   - From black FG plug to CH1 black oscope plug
   - Also from red FG plug to leading side of Decade Resistance box (dial resistance to < 100 Ω)
   - Also from black side of FG plug to "E" plug on the 2.2 mH Inductor
   - From trailing side of Decade Resistance box to "A" plug on 2.2 mH Inductor
   - Also from "A" plug on Inductor to CH2 oscope (single spring clamp hook from CH2)

2. Set the FG to square wave and start in the vicinity of 1500Hz. With the oscope Vert Mode set to CH1, select 1V/div for the vertical scale and use the Amplitude adjustment on the FG to fill the vertical scale of the oscope screen (8V peak-to-peak). Set the horizontal time scale at 50μs/div.

3. Switch the oscilloscope to channel 2. Use the vertical and horizontal adjustment knobs to place the decay curve in a position which allows you to most easily locate the x/y intersection where τ is found. You may have to adjust the horizontal time scale and you may have to adjust the FG amplitude and frequency to get a nice looking decay curve on the oscope screen.

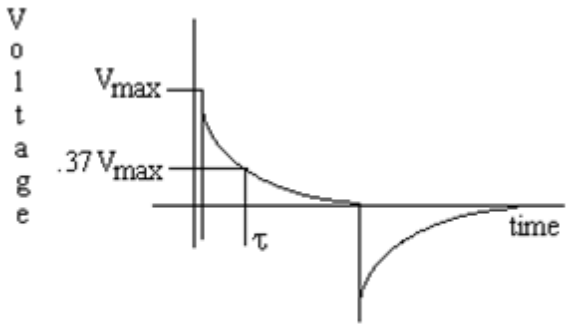

Figure 4

4. Measure τ from the oscilloscope screen, as shown in Figure 4, and record the value in the table on next page. This will be the **O**bserved value for τ.

5. Unplug the plugs from the Decade Resistance box and measure the actual resistance using the multimeter (it should be very close to the dialed-in value). Record the actual resistance in the table.

6. Calculate the **A**ccepted value for τ using your R and L values (you may assume the L value is as stated on the inductor). Record this value in the table.

7. Calculate the percent error between the experimental (**O**bserved) value and the calculated (**A**ccepted) value of τ using the formula $\%E_R = \frac{O-A}{A}(100)$. Record your % Error in the table.

8. Repeat steps 1 – 7 using the 36 mH inductor and a resistance value between 200 - 500 Ω

9. For Trial 3, you will determine the Inductance of the larger unknown inductor. You should dial the resistance to 15,000 – 18,000 Ω and make necessary adjustments on the oscope to get a good looking decay curve. Using the τ from the oscope and the known R, calculate L.

10. For Trial 4, you are to use your knowledge of what a good RL curve looks like on the oscilloscope and determine the inductance of the smaller unknown inductor. Dial in an appropriate resistance on the decade resistance box to establish a good RL curve.

11. For Trial 5, use the 2.2 mH inductor and the unknown (red dot) resistor. Adjust the settings on the oscope to get a good looking decay curve, and determine the time constant from the decay curve, then use the time constant and the known L to calculate the **O**bserved R. Then, using the multimeter measure the **A**ccepted R and calculate the percent error.

12. For Trial 6, use the 36 mH inductor and the unknown (blue dot) resistor. Adjust the settings on the oscope to get a good looking decay curve, and determine the time constant from the decay curve, then use the time constant and the known L to calculate the **O**bserved R. Then, using the multimeter measure the **A**ccepted R and calculate the percent error.

Trial	Inductance (mH)	Resistance (Ω)	Observed Time Constant from Oscope (s)	Accepted Time Constant from Calculation (s)	% Error (%)
1	**2.2**				
2	**36**				
3				XXXXXXXXXX	XXXXXXXXX
4				XXXXXXXXXX	XXXXXXXXX
5	**2.2**			XXXXXXXXXX	
6	**36**			XXXXXXXXXX	