

EXPERIMENT #10 - PHYSICS231

A.C. Impedance (Part II)

OBJECT: To study the effects of inductance, capacitance, and resistance connected in series to an alternating current source.

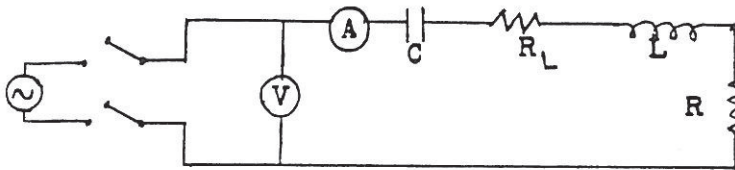
EQUIPMENT:	inductor (860 mH)	A.C. source (35 V, 60 Hz)
	resistor (100 W light bulb)	D.C. ammeter (1 A)
	capacitor (10 μ F & 4 μ F)	D.C. voltmeter (30 V)
	A.C. ammeter (1 A)	D.C. source (25 V)
	A.C. voltmeter (150 V)	dual trace oscilloscope

THEORY: Refer to lecture and chapter 39 of Halliday and Resnick

GENERAL DIRECTIONS:

1. Connect the following circuit and measure the voltage and current as indicated:

35 V
A.C.



V = A.C. voltmeter (0-150 V)
 A = A.C. ammeter (0-1 A)
 C = capacitor (10 μ F)
 L = inductor (860 mH)
 R = light bulb resistance
 R_L = D.C. resistance of inductor

Be careful when you are using the circuits in this experiment since it is possible to accidentally receive a serious electrical shock. It is necessary to separately measure the voltage across R for this circuit in order to find the value of R since R will vary with current. The inductor's resistance (R_L) may be printed on the coil or found by using an ohmmeter. Using the voltage and current data find the magnitude of the total impedance of this circuit. Also, find the phase angle θ between the voltage source and the current of this circuit by considering the power supplied by the voltage source ($VI \cos \theta$) and the power delivered to the resistances ($I^2 R + I^2 R_L$).

2. By using a dual trace oscilloscope properly measure the phase angle between the A.C. voltage source and the voltage across the light bulb. Be sure you clearly understand how to properly connect the oscilloscope to your circuit before activating your circuit. Compare this value of phase angle to the value measured in part 1 and discuss the phase relationship between the voltage across the light bulb and the current through the circuit.
3. Using the known values for L, C, R, and R_L and the proper theoretical calculations verify the values of the impedance magnitude and phase angle that were found in part 1. Draw the appropriate impedance diagram.
4. In the circuit of part 1 of this section replace the capacitor C with the 4 μ F capacitor. Repeat parts 1, 2 and 3 of this section.
5. Explain why there may be any experimental errors in this experiment.