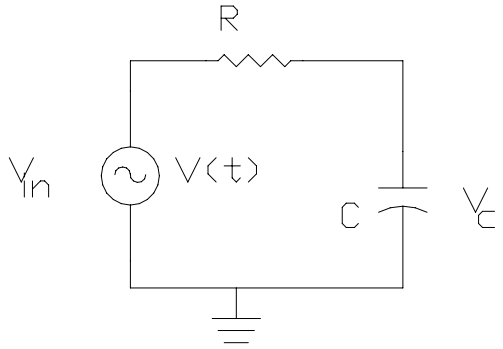
ET 304A
Electric Circuits Laboratory
Lab 9
Ac Circuits and Phasor Algebra

Objective: Measure the ac voltages with an oscilloscope and verify the phase relationships between voltages in a ac circuit using phasor algebra.

Procedure

Part 1: R-C Circuits

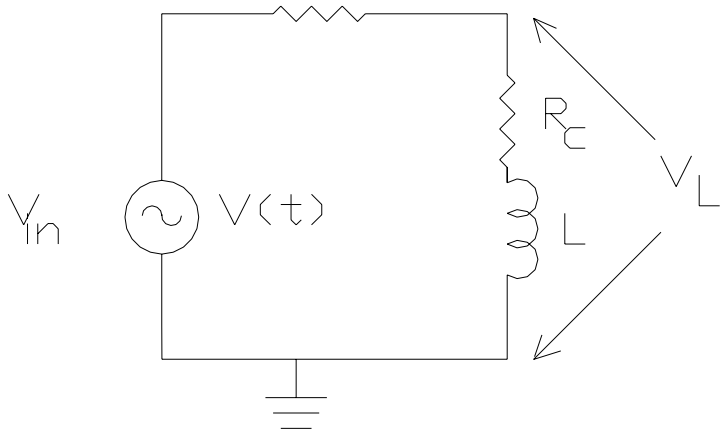
1.) Construct the circuit below with a value of R=15kΩ and a value of C=0.01 μF. The source voltage V(t) = 2sin(2πft) with f=1000 Hz.



2.) Sketch the scope traces of V_c and V_{in} on the axis provided. Indicate the voltage and time scales. Measure the phase shift for later reference. Use V_{in} as the zero angle phasor.
3.) Calculate the theoretical values of V_c using phasor algebra. Comment on the accuracy of the results in the lab report.
4.) Let R=4.7kΩ and sketch the trace of the new V_c as was done in step 2 on the same axis. Calculate the theoretical values for comparison.
5.) Let R=33kΩ and repeat step 4
6.) Comment on how the change in resistance affects the phase angle between V_{in} and V_c as the value of R changed.

Part 2: R-L Circuits

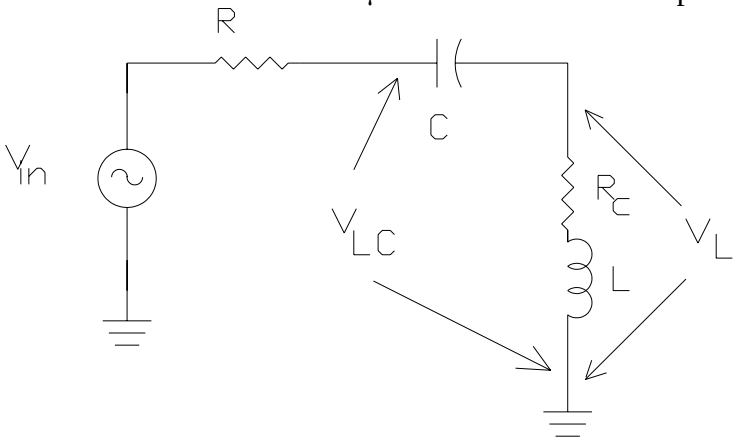
1.) Construct the circuit below with L=10 mH. The source voltage V(t) = 2sin(2πft) with f=10,000 Hz. Size the R such that $R=X_L$ when the source frequency is 10 kHz.
2.) Measure the dc resistance of the inductor coil, R_c, and record it for future use.



3.) Compute the Q of the inductor when it operates at the source frequency.
4.) Measure V_{in} and V_L and sketch them on the provided sheets. Measure the phase for later use.
5.) Calculate the theoretical values of V_L using phasor algebra. Comment on the accuracy of the results in the lab report.
6.) Let R=15 ohms and graph the trace of V_L on the same axis. Calculate the theoretical values as in step 5.
7.) Repeat step 6 with R=680 ohms.
8.) Comment on how the change in resistance affects the phase angle between V_{in} and V_L as the value of R changed. Compare the measured values to the theoretical in the report.

Part 3: R-L-C Circuits

1.) Construct the circuit below with C=0.01 μF and L=10 mH. Compute the series



resonant frequency using:

$$f_s = \frac{1}{2\pi\sqrt{LC}} \quad \text{Hz}$$

Now find the value of R by letting $R = X_L = X_C$ with X_L and X_c given by:

$$X_L = 2\pi fL$$

$$X_C = \frac{1}{2\pi fC}$$

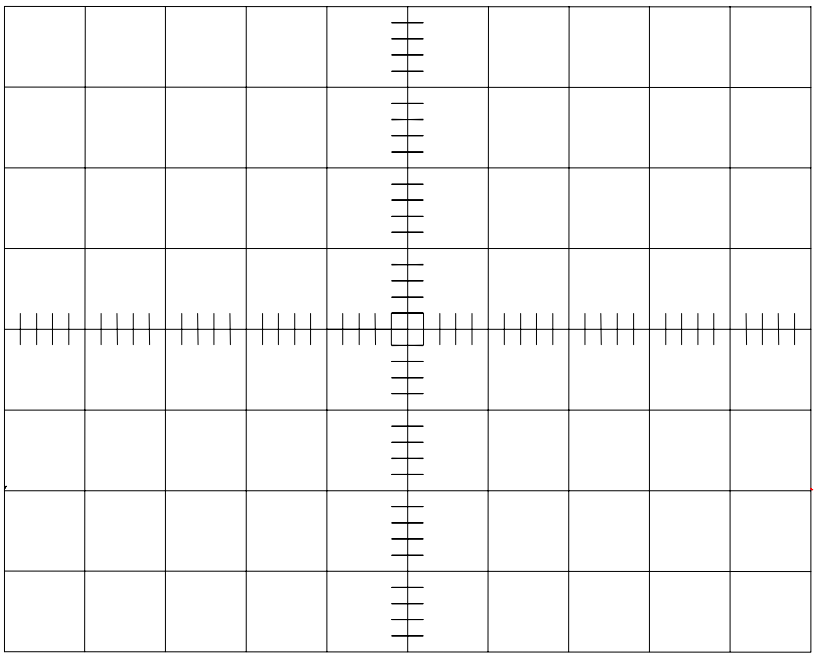
The value of V_{in} is set to the resonant frequency and is given by $V_{in}=2\sin(2\pi f_s t)$

2.) Measure the voltages V_{in} V_L, and V_{LC}. Sketch the traces on the same axis.
3.) Find the phasor value of Vc, the voltage across the capacitor, from the measured values of V_L and V_{LC}. Compare this to the theoretical values by using phasor algebra.

Report:

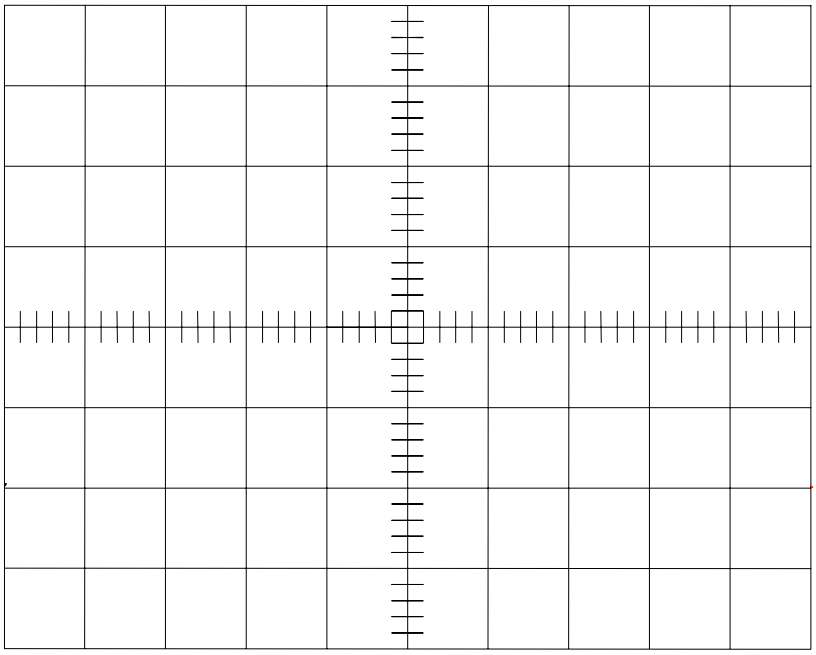
1.) Follow the outline for the standard lab report.
2.) All data must be in tables. Make tables that compare the theoretical and measured phasor values for each part.
3.) Use the attached graph sheets to sketch the scope traces for each part. Make photo copies of this page if necessary.

Part _____



Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____

Part _____



Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____