US DOL SPONSORED TAACCCT GRANT: TC23767
PRIMARY DEVELOPER: Jim Blair – Henry Ford College

Basic Electricity – Unit 15: Inductance and AC

Lab 1

Objective
The purpose of this lab is to discover how series resonant RLC circuits behave. An important property of this circuit is its ability to resonate at a specific frequency. This is an important concept necessary when designing circuits which will be used for: band-pass filters, band-stop filters, low-pass filters or high-pass filters.

Safety and PPE Usage:
Care must be taken when working with electrical devices. If you are not familiar with electrical safety rules please go to that section NOW.

In the lab NO food or beverages are allowed.

Use all Hand Tools in a safe and proper way. If in doubt ask your instructor.

Possible hand tools needed for this lab:
1. Needle nose pliers
2. Small screwdriver
3. Large screwdriver
4. Wire strippers
5. Diagonal pliers
6. Soldering iron

Possible equipment needed for this lab:
1. DC power supply
2. AC signal generator
3. Oscilloscope
4. Multimeters
5. Breadboard
6. Computer
7. Test leads
8. Oscilloscope probes
9. hook up wire

Parts list required for this lab:

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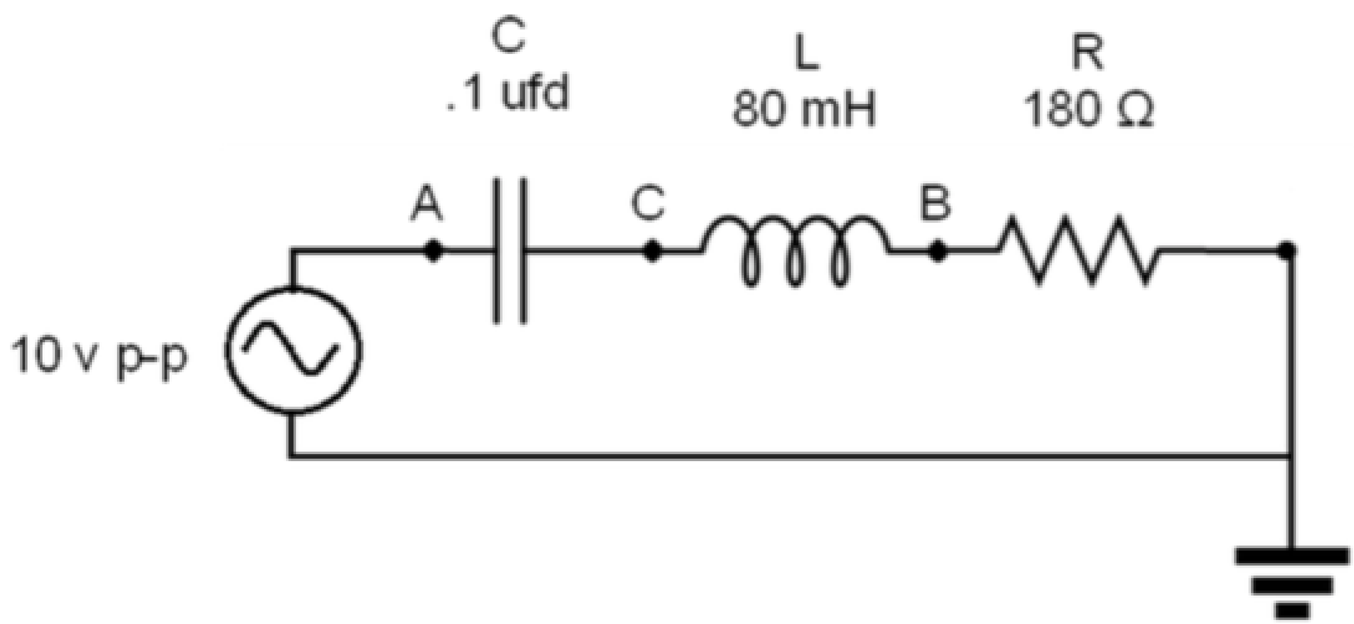
1. .1 ufd capacitor
2. 80 mH coil
3. 180 ohm resistor

1. Construct the following circuit.



2. Set up the signal generator to 10 v p-p at 100 hz.. Make sure your signal generator is set to sine wave output. Monitor this with channel 1 of an oscilloscope. This can be accomplished by connecting channel 1 of the oscilloscope to point A in the circuit.

3. Place the oscilloscope probe at Point B once the signal generator is adjusted as in step 1. The voltage at Point B will be small compared to step 1. This will mean an adjustment of the oscilloscope settings in order to read the output at Point B.

4. Record the p-p voltage measured in step 3 in data table 1. provided. This is the voltage developed across the resistor in the circuit.

4. Adjust the signal generator frequency to the given values listed in data table 1. Each change in frequency will mean a change in voltage developed across the resistor of the circuit. Record the voltage measured across the resistor for each new frequency. Once again, this is the voltage at Point B.

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DATA TABLE 1.

FREQUENCY in HZ.	VOLTAGE p-p at POINT B	FREQUENCY in HZ.	VOLTAGE p-p at POINT B	FREQUENCY in HZ.	VOLTAGE p-p at POINT B
100		1,200		2,300	
200		1,300		2,400	
300		1,400		2,500	
400		1,500		2,700	
500		1,600		3,000	
600		1,700		4,000	
700		1,800		5,000	
800		1,900		8,000	
900		2,000		10,000	
1,000		2,100		15,000	
1,100		2,200		20,000	

5. On the provided semi-log graph paper plot the output p-p voltage vs. the frequency. You will need to put several sheets together to fit your results.

6. Describe what your plotted data shows. Give a brief description in your own words what you have learned about series resonant RLC circuits.

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Note: The frequency at which the voltage across the 180 Ω resistor peaked to a maximum value is called the series resonant frequency.

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Another method of finding this value is using the following equation.

$$F_{Resonance} = \frac{1}{(2)\pi\sqrt{LC}}$$

7. Use the formula and calculate your frequency of resonance.

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Calculated $F_{Resonance}$ = ______________________

8. Examine your graph and determine the actual value of $F_{Resonance}$ (NOTE: This will be the Maximum value plotted on your graph)

Actual $F_{Resonance}$ = ______________________

9. Use the following formula and determine the percent difference between your actual and calculated values of $F_{Resonance}$.

% Difference between actual and measured values =
{(FR actual - FR calculated) / FR actual } x 100

Your % Difference = _____________

10. Adjust the signal generator to your actual resonant frequency value. This is the value you found in step 8.

11. Measure the p-p voltage across the 180 Ω resistor.

$V_{Resistor}$ = ___________

12. Use Ohm's Law and determine the current flow through the 180 Ω resistor.

$I_{Resistor}$ = ____________________

13. Move the oscilloscope probe to Point C. Measure the voltage at Point C.

Voltage at Point C = ______________________

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14. Move the oscilloscope probe to Point A in the circuit. Measure the input voltage to the circuit at Point A. Note: Point A is the output of the signal generator. Point A is also the input to the circuit.

Input voltage at Point A = ______________________

15. Give a statement for your explaination of why the voltages at Point A and Point C are what they are.

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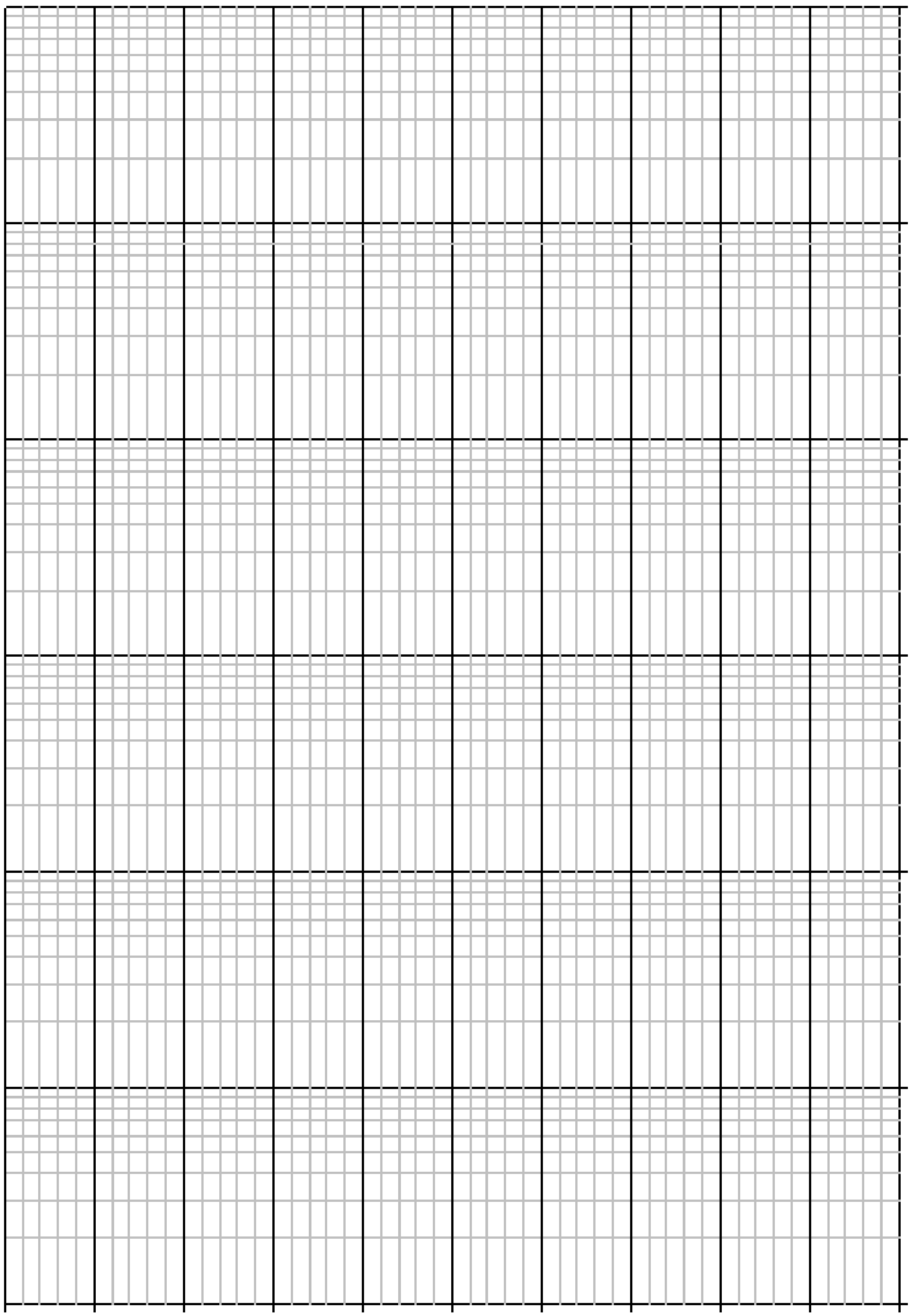

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