ELT 101: Basic Electricity: AC/DC

Lab 14-1: Capacitive Circuits

A capacitor opposes any change in voltage. Capacitors also have the ability to store a charge. Capacitors block DC, but pass AC. What's more the amount of opposition the capacitor offers to current depends on the frequency of the current. This makes capacitors useful as filters. In this lab, we'll look at some basic capacitive circuits.

Objectives

1) Calculate total capacitance for series, parallel and series-parallel capacitors.
2) Verify your calculations by constructing each circuit and measuring total capacitance.
3) Observe a demo of a RC circuit's time constant

Equipment and materials

1) Safety glasses
2) EXTECH LCR meter
3) Electrical trainer
4) Jumper leads

<u>Procedure 1: Calculate total capacitance for series, parallel and series-parallel capacitors</u>

The electrical trainer has three capacitors: (C1) 330uF, (C2) 470uF and (C3) 470uF.

1) Calculate total inductor for the combinations shown in the table below.

Circuit	Calculated capacitance	Measured capacitance
C1 and C2 and C3 in series		
C1 and C2 and C3 in parallel		
C1 in series with C2/C3 in parallel		

Procedure 2: Verify your calculations by constructing each circuit and measuring total capacitance.

1) Construct each of the capacitive circuits and use the EXTECH LCR meter set to read capacitance to measure each total capacitance. (If you need help using the LCR meter, just ask your instructor for help.)

2) Record each total capacitance in the table on page 1.

3) Do your measured total capacitances match your calculated total capacitances? If not, why not?

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Procedure 3: Observe a demo of a RC circuit's time constant

Ask your instructor to hook up the 220 ohm resistor in series with the 470uF capacitor.

1) Calculate the time constant for this circuit using the formula TC = RC

2) Record your time constant below.

TC = _____

3) Given this, how long will it take the capacitor to completely charge?

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4) Ask your instructor to inject a 20 Hz square wave into the circuit using a function generator and then observe the resulting output with an oscilloscope.

5) Does the resulting display match your calculations? If not, why not?

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