Introduction to Capacitance [1]

Equipment Needed:

1 Act-1 Experimental Circuits Kit/Circuit Board	Demo cart
1 Digital Multimeter/Capacitance Tester	Demo cart
1 Oscilloscope (Optional)	Demo cart
1 Capacitors (assorted)	Demo cart

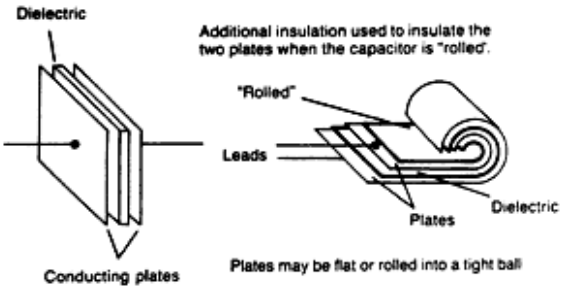

Figure 1: Capacitor Construction

Purpose

You will learn to use a digital multimeter (DMM) to measure the capacitance of different combinations of capacitance. The measurements will be compared with the theoretical calculations.

Introduction and Precautions

Capacitors have voltage ratings. The voltage rating is a maximum rating and should never be exceeded. If exceeded, arcs can occur between the plates, destroying the insulating material. When this happens the capacitor will no longer charge. Both capacitance and voltage ratings are printed on the body of most capacitors. Some older tvpes used color codes. Other characteristics such as change in value with temperature changes and tolerance may be printed on the case. These are usually printed in code (see Figure **??**). Some codes are standardized and others are not.

Care must be exercised in handling capacitors. Many are non-polarized and can be placed in the circuit in any way. Others usually large-value electroltics, are polarized and MUST be placed into the circuit + to + and - to -. If not they may EXPLODE and cause injury. Never exceed the voltage rating.

[1] Adapted from PASCO Basic Electricity ©1993, PASCO Scientific Roseville, CA

Procedure

1. Choose the five different capacitors. Use the Multimeter to measure the capacitance of each of your capacitors. Enter these values in Table 1.

Table 1: Capacitance Measurement

C_1	C_2	C_3	C_4	C_5

Experimental error = $|\frac{Measured-Coded}{Coded}| \times 100\%$

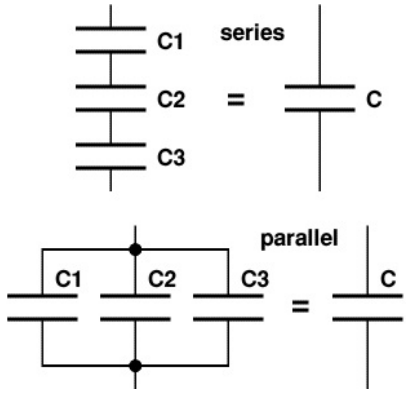

Figure 2: Capacitors in Series and in Parallel

2. Now choose three out of the five capacitors and connect them into the SERIES circuit in Figure 2. You should choose capacitors that have similar order of magnitude, record the capacitance of the chosen capacitors below Table 2. Measure the capacitances of the combinations as indicated on the diagram by connecting the leads of the Multimeter between the points at the ends of the arrows and record your result in Table 2. Use the measured values in Table 1 to calculate the theoretical values and find the percentage difference.
3. Construct a PARALLEL circuit as in Figure 2, first using conbinations of two of the capacitors, and then using all three. Measure and record your values for these circuits in Table 3.
4. Construct a COMBINATION circuit as in Figure 3. Measure and record your values for these circuits in Table 4. Remember to switch off the meter when you are done.

Table 2: Capacitors in Series

Capacitor	Measured	Theory	Percentage Difference
C_{12}			
C_{23}			
C_{123}			

$C_1 =$ _____, $C_2 =$ _____, $C_3 =$ _____

Table 3: Capacitors in Parallel

Capacitor	Measured	Theory	Percentage Difference
C_{12}			
C_{23}			
C_{123}			

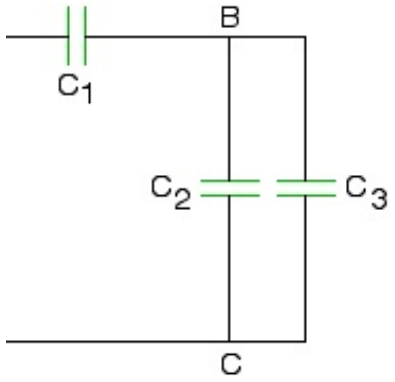

Figure 3: Capacitors in Combination

Table 4: Capacitors in Combination

Capacitor	Measured	Theory	Percentage Difference
C_{123}			