GOALS - The goals of this lab are to;

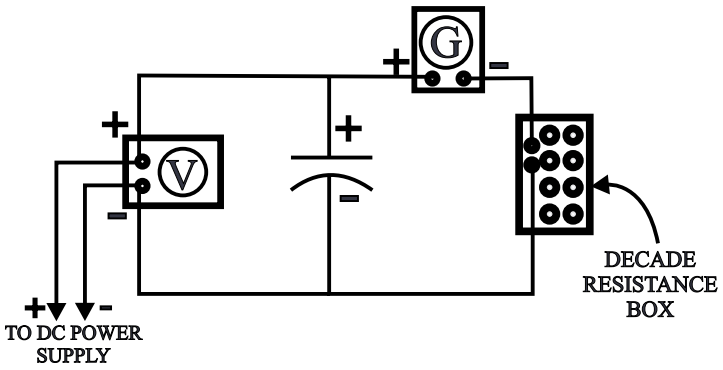
a. Measure the capacitance of a parallel plate capacitor.

b. To determine the capacitance of two capacitors in parallel.

c. To determine the capacitance of two capacitors in series.

PROCEDURE -

1. Connect up the circuit as shown to the right.
2. First be sure that the power supply built into the desk is turned **OFF** and the dial turned to **ZERO**!
3. Connect two clip leads to the red and black terminals of the power supply built into the desk. [Or other portable power supply as available.]
4. Connect the other ends of these clip leads to a voltmeter on top of the lab table.
5. From the voltmeter connect two other leads across a capacitor. Be sure that the polarity of the capacitor matches that of the power supply, negative to negative and positive to positive! [Electrolytic capacitors have the nasty habit of **exploding** when placed in a circuit with the wrong polarity!]



6. Now, connect another clip lead from the positive end of the capacitor to the positive terminal of the galvanometer, a second clip lead between negative end of the galvanometer and the decade box resistance and finally a third clip lead between the decade box and the negative end of the capacitor. At this point your circuit should be complete and should look like the diagram above.
7. Adjust the decade resistance box to a value of approximately R = 10,000 Ω. [This resistance may need to be adjusted up or down depending on how quickly the capacitor discharges. The purpose of the resistor is to discharge the capacitor at a controlled rate suitable for data collection.]
8. Turn the power supply **ON** and slowly turn up the power supply until the reading on the galvanometer, with the third button depressed, has reached 500 μAmperes. [It is a bit confusing , but the actual reading on the Galvanometer will be "50" when the current flow is 500 μAmperes.] A digital multimeter may be substituted for the galvanometer - using the microamp scale.
9. At this point the system is at equilibrium. That is, the capacitor is discharging through the decade resistance box at the same rate at which it is being recharged by the power supply.
10. Record the reading on the Voltmeter $\mathbf{V_o}$ and then disconnect one of the clip leads attached between the capacitor and the Voltmeter.
11. Record the reading on the Galvanometer **every 5 seconds** until the reading falls below 20 μAmperes. [Remember that 20 μAmps will correspond to "2" on the galvanometer scale!]
12. Repeat step 11. If the reading are substantially the same you have completed this portion of the lab procedure.
13. Make a graph plotting the current flowing out of the capacitor as a function of time. From this graph determine the total charge stored in the capacitor either by determining the area under the curve by **counting the number of blocks** under the curve and then multiplying this number by the area of each block, and by **determining the equation of the line** and then determine the **area by integrating between zero and infinity**. Compare these two values.
14. Calculate the capacitance of the capacitor $\mathbf{C_m}$ by taking the ratio of charge stored to the voltage applied.
15. Compare this value to the given capacitance. Make the appropriate bar graph comparing the **capacitance value printed on the capacitor C** with the **measured capacitance $\mathbf{C_m}$ of this capacitor**.
16. Remove the above capacitor from the circuit and replace it by two different, but comparable, **capacitors connected in parallel**. Repeat steps 7 - 15 above until you have determined the total capacitance of two capacitors connected in **parallel**. Compare this **measured, equivalent capacitance** with the corresponding **theoretical value** for **capacitors in parallel**.
17. Remove the above capacitors from the circuit and replace them by two different, but comparable, **capacitors connected in series**. Again repeat steps 7 - 15 above until you have determined the total capacitance of two capacitors connected in series. Compare this **measured, equivalent capacitance** with the corresponding **theoretical value** for **capacitors in series**.

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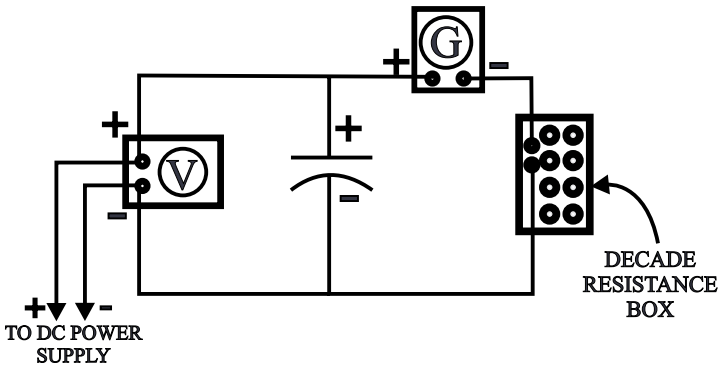

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