**University of Palestine**



**College of Applied Engineering & Urban Planning**

**Experiment 8**

**Capacitors in Parallel and series**

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| **Instructor's Name** |  |
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| **Date** |  |
| **Section** |  |
| **Grade** |  |
| **Notes** |  |

**Experiment 8**

**Capacitors in Parallel and series**

Objectives:

Familiarization with the characteristics of parallel and series capacitors.

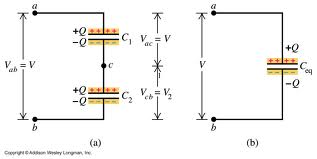
Theory:

Like resistors, the series and parallel combination of **capacitance** is important in the servicing line. Sometimes it is difficult to get an exact **capacitor value** and voltage rating in the market, therefore you have to use the series and parallel combination of capacitance to achieve your desire capacitor value and voltage rating for replacement

Capacitors may be connected in series or in parallel to obtain a resultant value which may be either the sum of the individual values (in parallel) or a value less than that of the smallest capacitance (in series).

1. **Capacitors in series**

In series combination the distance between the plates increase, so the total capacitance is reduced when the capacitors are connected in series. The net capacitance is less than the lowest capacitance present in the series circuit. The results are exactly the same as the resistances in parallel.



The potential difference across each capacitor however is different. Therefore,

V = V1 + V2 (7-1)

But V=Q/CT, V1=Q/C1 and V2=Q/C2 (7-2)

By substituting equation (7-2) into (7-1) yields:

Q/CT= Q/C1+ Q/C2  (7-3)

Then we have

1/CT= 1/C1+ 1/C2  (7-4)

Where CT is the effective capacitance, when capacitors are connected in series.

This implies that when the capacitors are connected in series, the reciprocal of the equivalent capacitance equals to the reciprocals of the individual capacitance.

Apparatus:

* Dc voltage source.
* Resistors.
* Voltmeter.
* Capacitors.

Setup and Procedure:

1. Connect the following circuit:

S R

C1

E

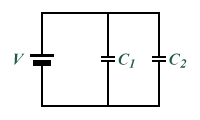
C2

1. Close switch S and measure the time required for capacitors to charge to a voltage equal 63% times the value of the voltage source. (This time equal one time constant).
2. Calculate the effective capacitance using equation (7-4).
3. Using the measured time constant, find the effective capacitance where (τ=R Ceff).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| C1 | C2 | Calculated Ceff | Measured time constant | Measured Ceff |
|  |  |  |  |  |

1. **Capacitors in parallel**

When capacitors are connected in parallel, one plate of each capacitor is connected directly to one terminal of the source, while the other plate of each capacitor is connected to the other terminal of the source. Following Figure shows all the negative plates of the capacitors connected together, and all the positive plates connected together. C T, therefore, appears as a capacitor with a plate area equal to the sum of all the individual plate areas. As previously mentioned, capacitance is a direct function of plate area. Connecting capacitors in parallel effectively increases plate area and thereby increases total capacitance

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Apparatus:

* Dc voltage source.
* Resistors.
* Voltmeter.
* Capacitors.

Setup and Procedure:

1. Connect the following circuit:

S R

E C1 C2

1. Close switch S and measure the time required for capacitors to charge to a voltage equal 63% times the value of the voltage source. (This time equal one time constant).
2. Calculate the effective capacitance using equation (7-4).
3. Using the measured time constant, find the effective capacitance where (τ=R Ceff).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| C1 | C2 | Calculated Ceff | Measured time constant | Measured Ceff |
|  |  |  |  |  |