

Series and parallel connection of capacitors

Aim of experiment:

Measurement of the equivalent capacitance of several capacitors connected in series and parallel

Introduction:

A capacitor consists of two conducting objects (plates) separated by a non-conducting medium (dielectric). The capacitance of such capacitor is defined as the ratio of the charge on the conducting plates to the potential difference across them.

Capacitors may be combined in series or parallel. (The figures below show both combinations).

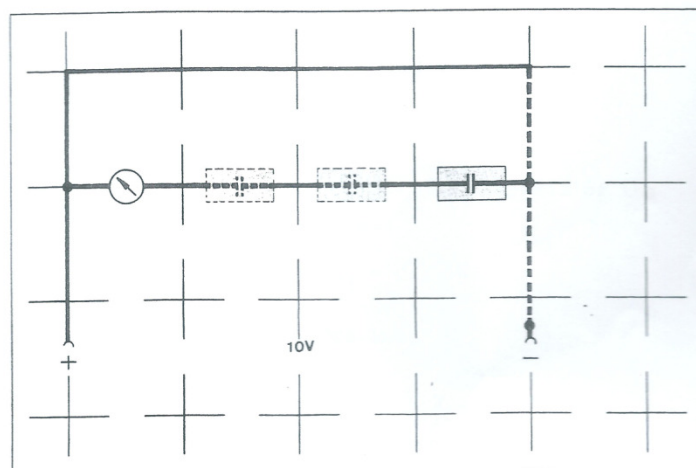
Theoretically the equivalent capacitance for the series connection is given by

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

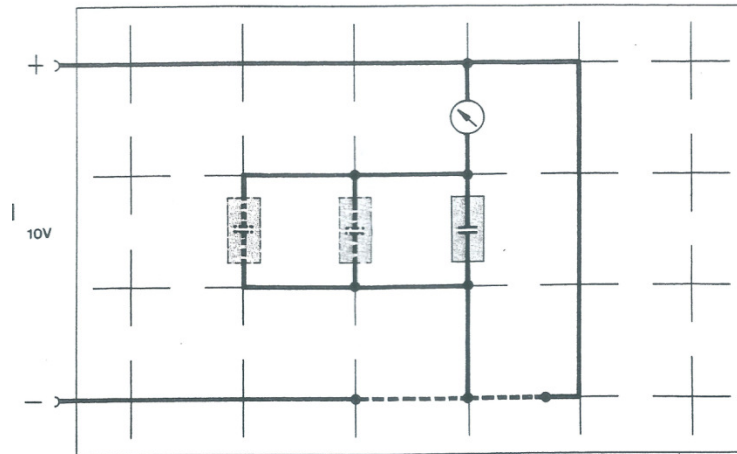
And the equivalent capacitance for parallel connection is given by

$$C = C_1 + C_2 + C_3$$

Circuits



Series connection of capacitors



Parallel connection of capacitors

Equipment and Components

1 Rastered socket panel

3 Capacitors, 4.7 μF

1 voltmeter

1 D.C. power supply unit

Bridging plugs

Connecting leads

Conducting the Experiment

1. Make sure that each capacitor is discharged ($V=0$) by touching the ends of a lead wire to the terminals of the capacitor.
2. Assemble the measuring circuits (series).
3. Connect the battery to the combination of capacitors
4. Raise the voltage V to 10 volts
5. Measure the voltage across each capacitor connected in series, tabulate the results.
6. Disconnect the capacitors, discharge them then connect them (in parallel).
7. Repeat steps 4 and 5 for the parallel connection, tabulate the results.

Results

C (Capacitors in series)	V (volts) measured	Q (coulomb) = CV
4.7 μ F		
4.7 μ F		
4.7 μ F		
	$V_{batt} =$	$Q_{av} =$
$C_{eq} = \frac{Q_{av}}{V_{batt}}, \quad C_{eq}(\text{measured}) =$		
$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}, \quad C_{eq}(\text{predicted}) =$		

C (Capacitors in Parallel)	V (volts) measured	Q (coulomb) = CV
4.7 μ F		
4.7 μ F		
4.7 μ F		
$C_{eq}(\text{measured}) = \frac{Q_{tot}}{V_{batt}}$	$V_{batt} =$	$Q_{tot} =$
$C_{eq} = \frac{Q_{tot}}{V_{batt}}, \quad C_{eq}(\text{measured}) =$		
$C_{eq} = C_1 + C_2 + C_3, \quad C_{eq}(\text{predicted}) =$		