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BIRZEIT UNIVERSITY

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ENEE2101

Basic Electrical Engineering Lab

Experiment 5

Capacitors – Series and Parallel

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Contents

Abstract :

this Experiment aims to identify the idea of how capacitors works and show the behavior of capacitors is series and parallel . different circuits will be built to take the data : current ,voltage and measure charge we use: Power supply ,Capacitors and resistors,Oscilloscope , Digital Multimeters.

Theory :

First of all We connected the following circuit :

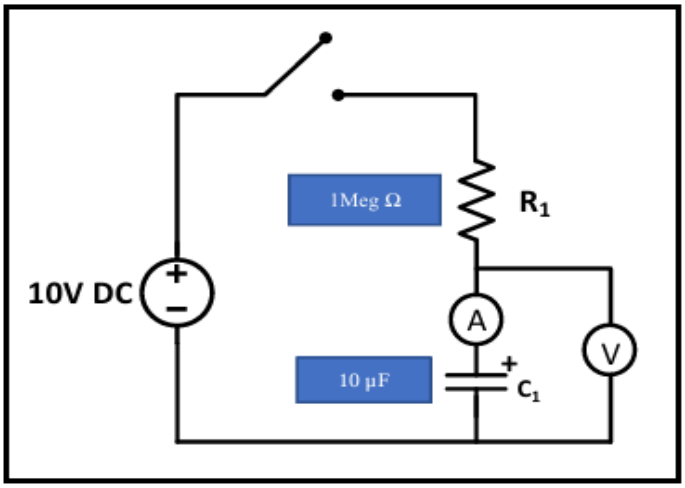


Figure 1part A circuit

We insured that the capacitor is fully discharged by shorting the terminals using a wire , then we turned on the voltage source and stared taking the values of V about the capacitor terminals .

Secondly we connected the following circuit :

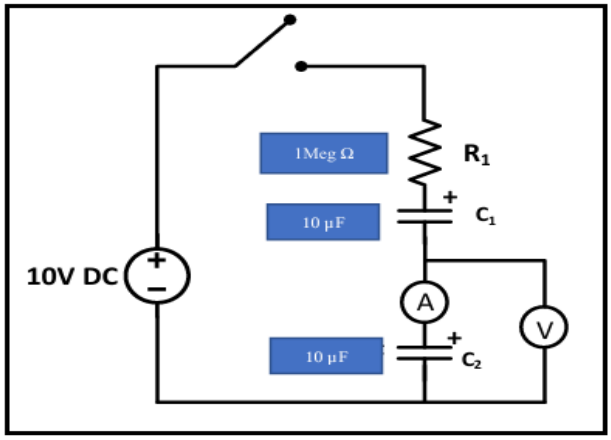


Figure 2part B CIRCUIT

After we finished writing the voltage values about the terminals of the capacitor , we added an ammeter to write the values difference of the current on the capacitor with time

Thirdly we connected the following circuit :

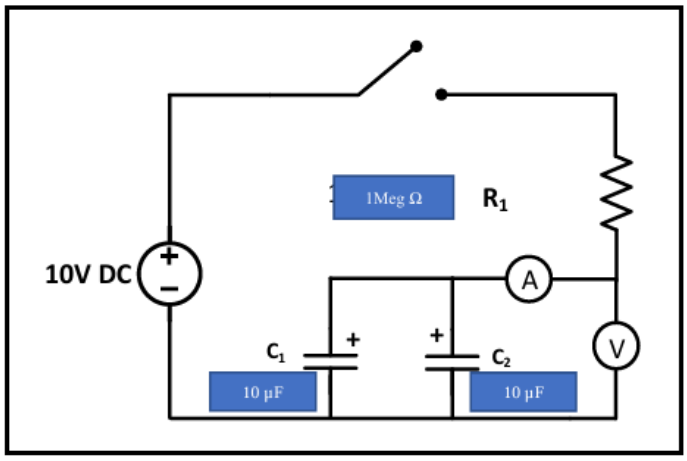


Figure 3the circuit of part C

In this circuit , we wrote the values of the current and voltage for the both capacitors that we connected in parallel , and immedietly after that we removed the resistor and wrote the values of the parallel capacitors values.

Procedure :

- **Part A : capacitance**

The following circuit was connected :

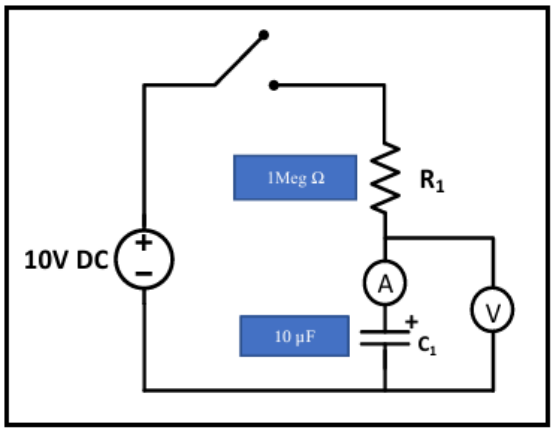


Figure 5.5

Figure 4procedure circuit part A

After we insured that the capacitor is fully discharged , we turned on the DC voltage source and the timer , and started taking the voltage values abouth the capacitor terminals.

- **Part B : capacitors in series :**

The following circuit was connected :

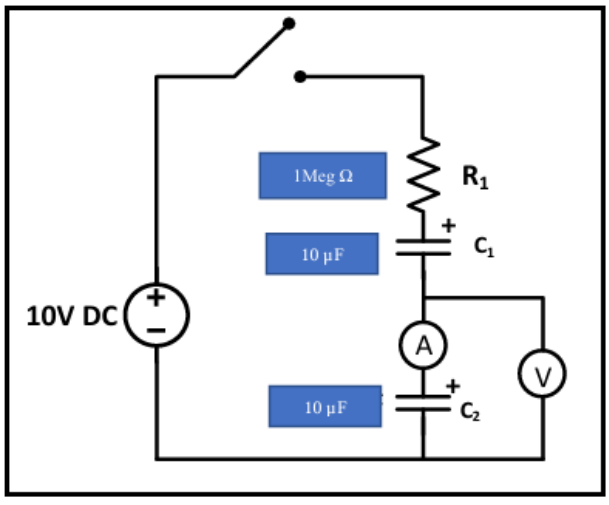


Figure 5procedure circuit part B

After we insured that both capacitors are fully discharged we turned on the voltage source and started writing the values of the current due to time about C2 .

After we finished writing the values of the current at t = 40 sec , we wrote the value of v about C2 terminals , and the value of V about C1 + C2 , then from the following equation :

V (C2+C1) – V(C2) = V(C1)

We found the value of V about C1 terminals .

- **Part C the capacitors in parallel :**

We connected the following circuit :

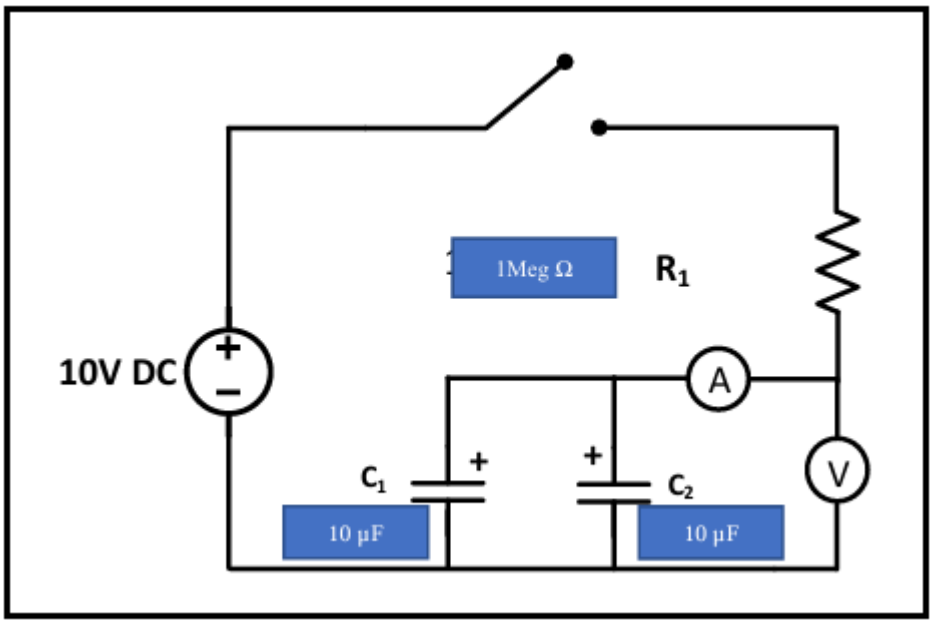


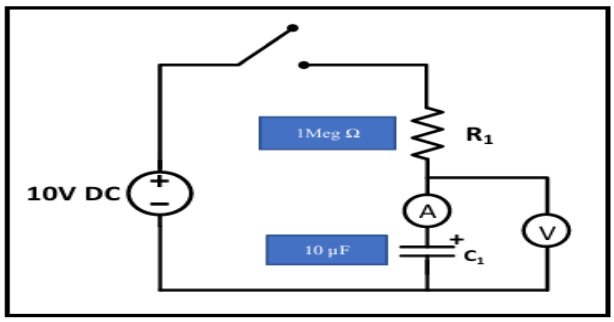
Figure 6procedure circuit part C

After we insured that both capacitors are fully discharged we connected the circuit and turned in the voltage source , and started taking the values of the current about the capacitors

and at t = 120 sec we took the value of the voltage about the parallel capacitors .

Data, Calculation, and Analysis of results

- **part A (capacitance) :**

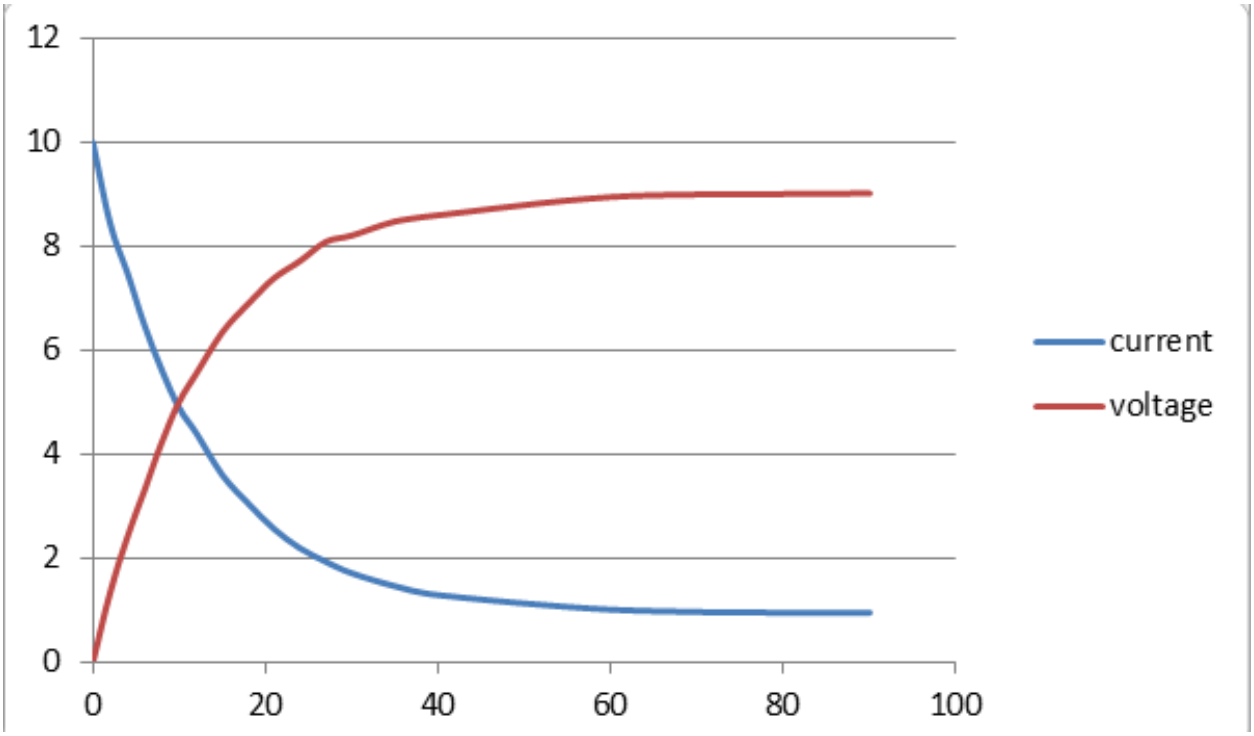


Time (s)	Current(micro ampere)	Voltage on C1 (v)
0	10	0
2	8.5	1.18
4	7	2.42
6	6.9	3.46
8	5	4.33
10	4.2	5.06
12	3.6	5.58
15	2.8	6.38
18	2.2	6.94
21	1.7	7.38
24	1.3	7.81
27	1	8.06
30	0.7	8.92
35	0.4	8.55
40	0.3	8.71
60	0	8.99
80	0	9.04
90	0	9.05

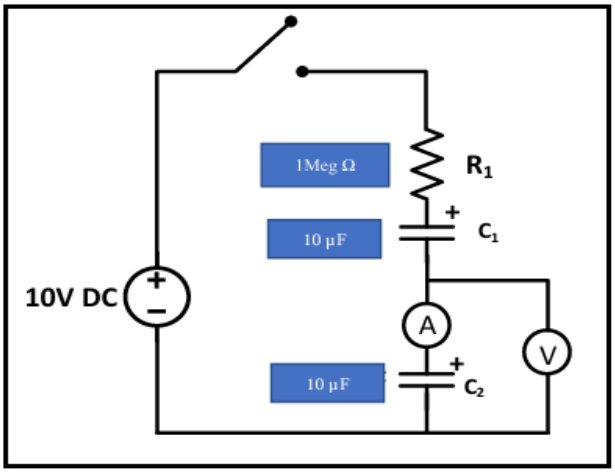
Table 1 current voltage change due to time part A

The capacitor didn’t arrive to the fully steady state where the capacitor becomes an open circuit where the current flow is equal to zero , but the value of A is acceptable and not too high.

the following chart shows the change in the voltage and current due to time :



- **Part B capacitors in series :**



Time (s)	Current (micro ampere)
0	10
2	7.5
4	5.6
6	3.9
8	2.7
10	2.0
12	1.2
14	0.8
16	0.5
18	0.2
20	0.1
24	0.1
28	0.2
35	0.2
40	0.3

Table 2current change due to time in part B

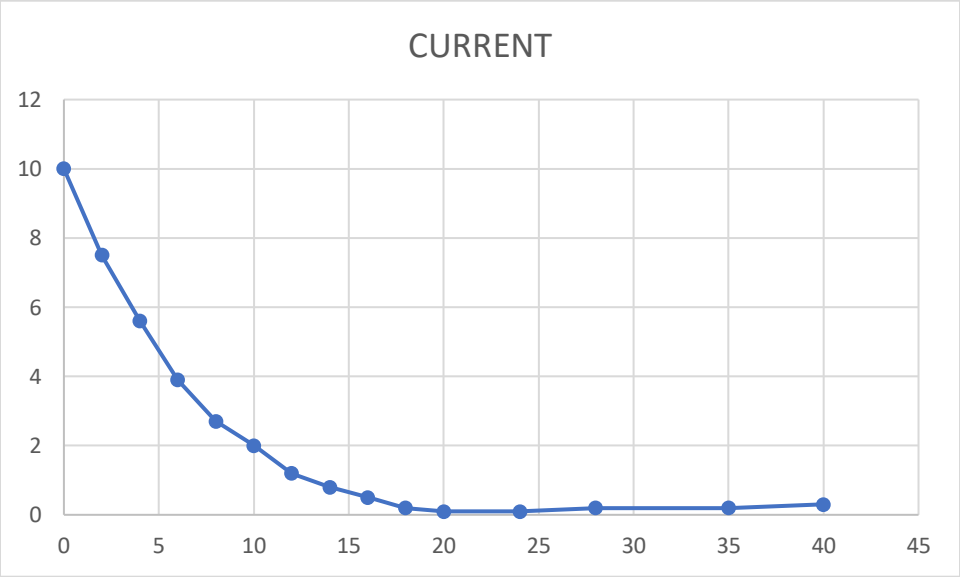
VC2	VC1+VC2	VC1
4.275	9.611	5.336

Table 3values of V at t= 40 sec

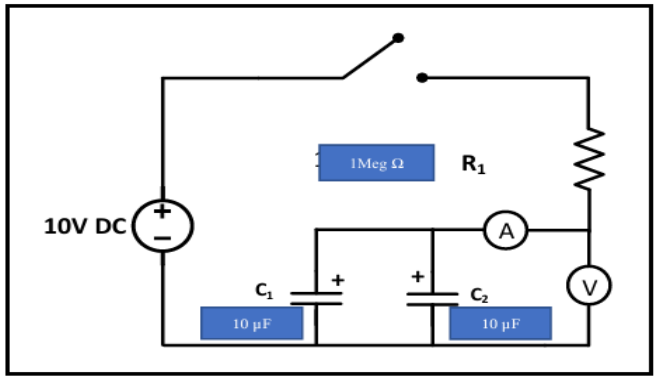
V (C2+C1) – V(C2) = V(C1) =5.336

The capacitors didn't arrive to the fully steady state where the capacitors become an open circuit where the current flow is equal to zero , but the value of A is acceptable and not too high .

The following chart shows the change of the current value due to time :



- **Part C capacitors in parallel :**



Time (Sec)	Current (micro ampere)
0	10
3	8.9
6	7.8
9	7.0
12	6.0
15	5.3
20	4.04
25	3.6
30	2.9
35	2.4
40	2.0
50	1.3
60	0.9
70	0.6
90	0.3
120	0.2

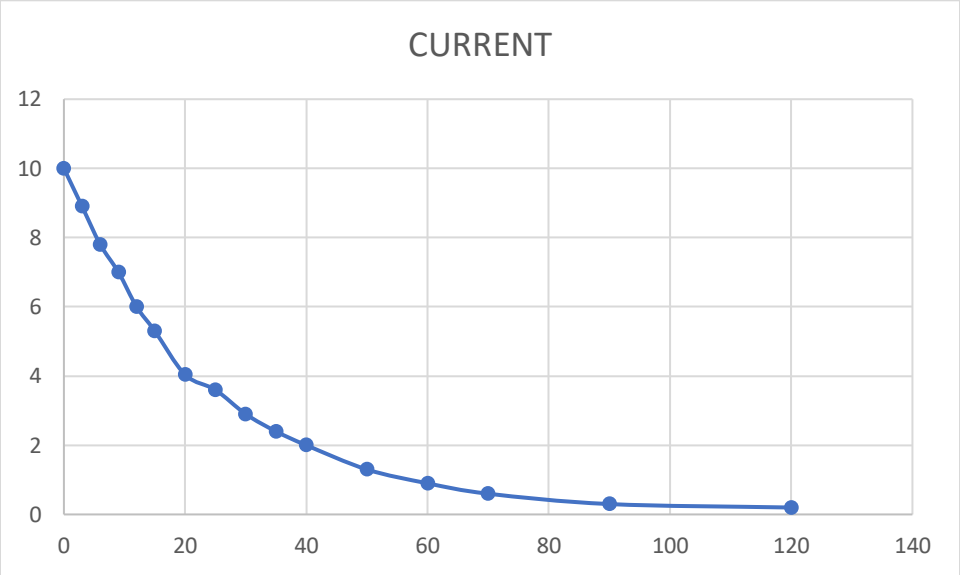
Table 4 current values for capacitors in parallel

Vpc	9.09

Table 5 value of V at t = 120

The capacitors didn't arrive to the steady state and the value of the current flow is too low which means we have a systematic error .

The following chart shows the change in current due to time :



Conclusion :

When The capacitors arrive to the steady state in DC circuits they become an open circuits where the current flow equal to zero , but in our experiment they didn't arrive to the fully steady state because some systematic and random errors like setting the timer after turning on the source in a few moments .

References :

[1] the labortary manual of the basic electrical circuits (ENEE2101)

[2] the values we got from our experiment

Experiment 5 - Data Tables:

Part A: Capacitance

Table 5.1

Time (s)	Current (μA)	Voltage on C_1 (V)	Charge (μC)
0	10	0	
2	8.5	1.18	
4	7.0	2.419	
6	6.9	3.457	
8	5.0	4.329	
10	4.2	5.061	
12	3.6	5.583	
15	2.8	6.382	
18	2.2	6.937	
21	1.7	7.375	
24	1.3	7.906	
27	1.0	8.062	
30	0.7	8.290	
35	0.4	8.583	
40	0.3	8.714	
60	0.00	8.986	
80	0.00	9.044	
90	0.00	9.054	

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Part B: Capacitors in series

Table 5.2

Time (s)	Current (μA)	Charge (μC)
0	10	
2	7.5	
4	5.6	
6	3.9	
8	2.7	
10	2.0	
12	1.2	
14	0.8	
16	0.5	
18	0.2	
20	0.1	
24	0.00	
28	0.2	
35	0.2	
40	0.3	

Table 5.3

At t = 40 s

V_{C2}	V_{C1+C2}	V_{C1}
4.275	9.611	5.336

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Part C: Capacitors in parallel

Table 5.4

Time (s)	Current (μA)	Charge (μC)
0	10	
3	8.9	
6	7.8	
9	7.0	
12	6.0	
15	5.3	
20	4.4	
25	3.6	
30	2.9	
35	2.4	
40	2.0	
50	1.3	
60	0.9	
70	0.6	
90	0.3	
120	0.2	

Table 5.5

V_{PC}	9.09v

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