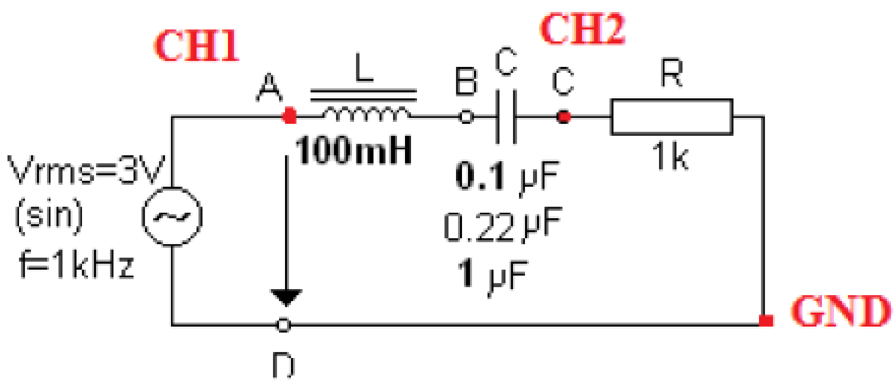
❖Introduction

In this experiment, we will identify the impedance of RLC circuit and determine the distribution of the applied voltage V and current I in the R,L and C elements.
We will also determine the phase angle between the voltage and the current for each element in the RLC circuit.

❖Procedure

✓ **Part One (**Series Circuit)

✓ In this part, after connecting the series circuit, we will find the voltages of each component in the circuit and the total current passes through the circuit and the phase angle (calculated and measured).



1. Set the function generator to Vrms=3V (Sinusoidal) and frequency=1 kHz.
2. Measure the values of VAB, VBC, VCD, Itot. (see the result in Table 1).

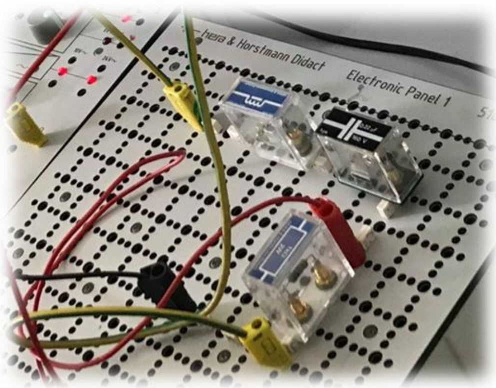
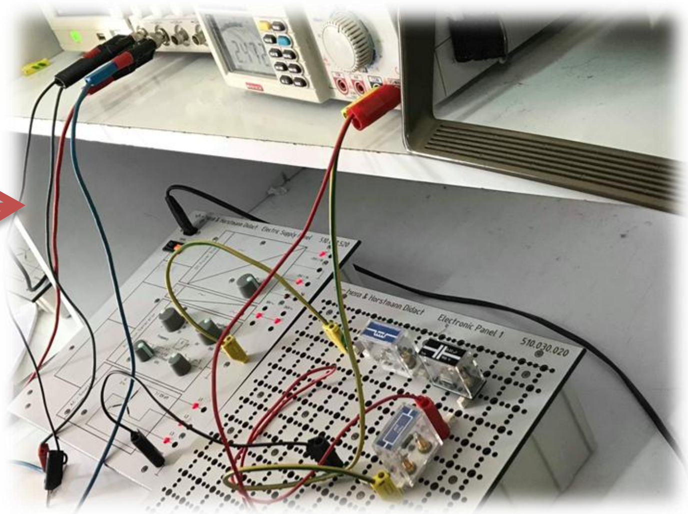



Table 1

C	VL(AB)	VC(BC)	VR(CD)	Itot	Vtot cal	Φ cal	Φ measured
0.1μF	1.3 v	3.1v	1.99v	1.93mA	2.68v	42	37.59
0.22 μF	1.63v	1.76v	2.47v	2.47mA	2.47v	3.01	0
1 μF	1.52 v	0.399v	2.32v	2.32mA	2.57v	25.78	21.6

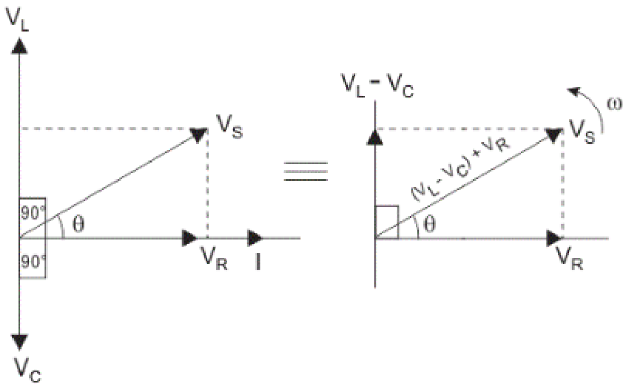
☒ calculations

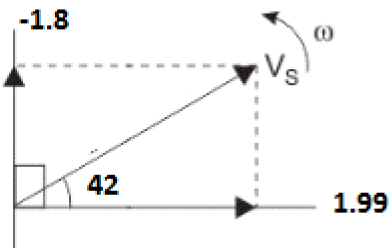
The total calculated voltage in series connection is given by the following equation:

$V_{tot\ Cal} = \sqrt{Vr^2 + (Vl - Vc)^2}$

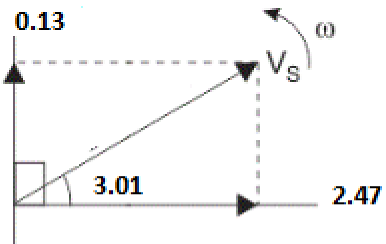
- Vtot(0.1μF)=2.68v
- Vtot(0.22μF)=2.47v
- Vtot(1μF)=2.57v

- (See the attached Fig. below)

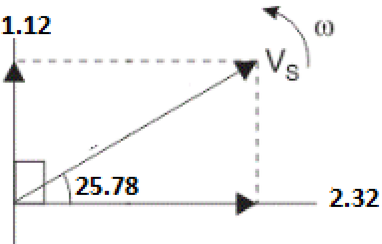




0.1μF
Vtot=2.68v



0.22μF
Vtot=2.47v



1μF
Vtot=2.57v

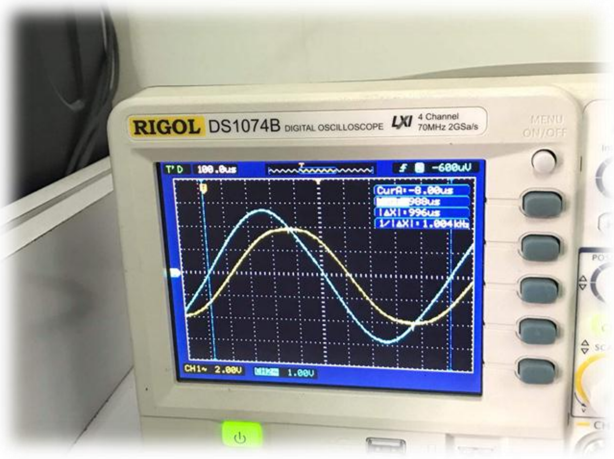
And to find the phase angle, we use the following equation:

$$\tan \Phi = \frac{Vl - Vc}{Vr}$$

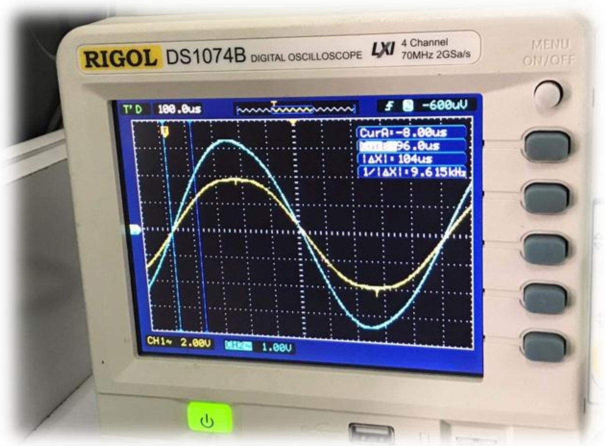
- Φ(0.1µF)= 42

  (Notice that the current sign comes

  Before the voltage sign).

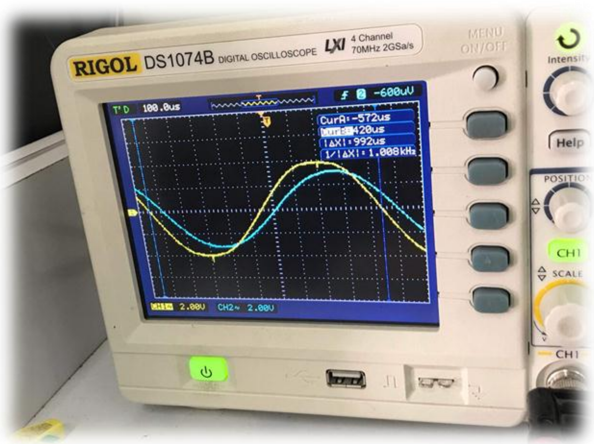


- Φ(0.22µF)= 3.01(in phase)



- Φ(1µF)=25.78

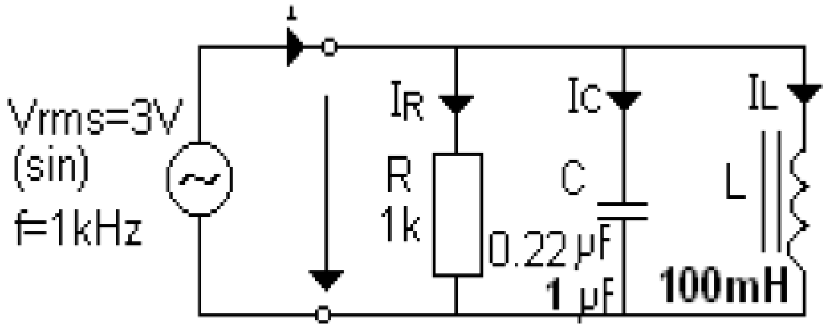
(voltage sign comes before).



✓ **Part Two** (Parallel Circuits)

In this part, after connecting the parallel circuit, we will find the currents of each component in the circuit and the total voltage and the phase angle (calculated).

1. Connect the circuit as shown.
2. To generate a current source using the source transformation, we can use a voltage source series with a resistor of 1 KΩ.
3. Set the function generator to V_{rms}=3V (Sinusoidal) and f=1 kHz.



C	I mA	IR mA	IC mA	ILmA	I tot cal mA	**Φ cal**
0.1µF	4.52	2.88	1.77	4.3	3.833	41.2
0.22µF	4.04	2.8	3.92	4.29	2.82	7.52
1µF	13.28	2.8	16.63	4.2	12.74	77.3

☒ **Calculations**

The total calculated current in parallel connection is given by the following equation:

$I_{tot\ Cal} = \sqrt{Ir^2 + (Ic - IL)^2}$.

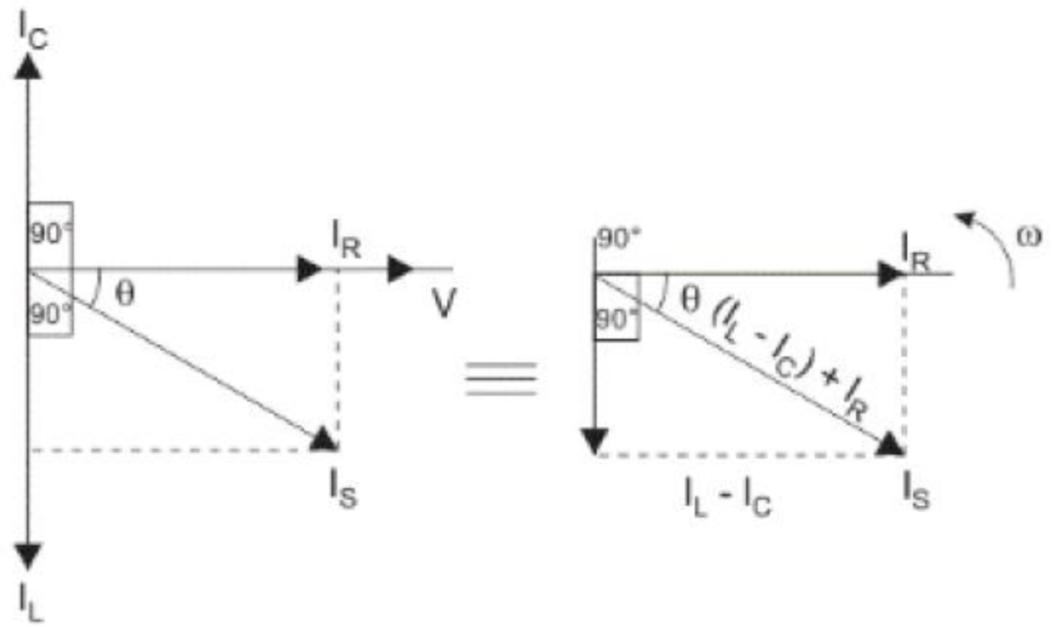
- Itot(0.1µF)=3.833 mA
- Itot(0.22µF)=2.82 mA
- Itot(1µF)=12.74 mA

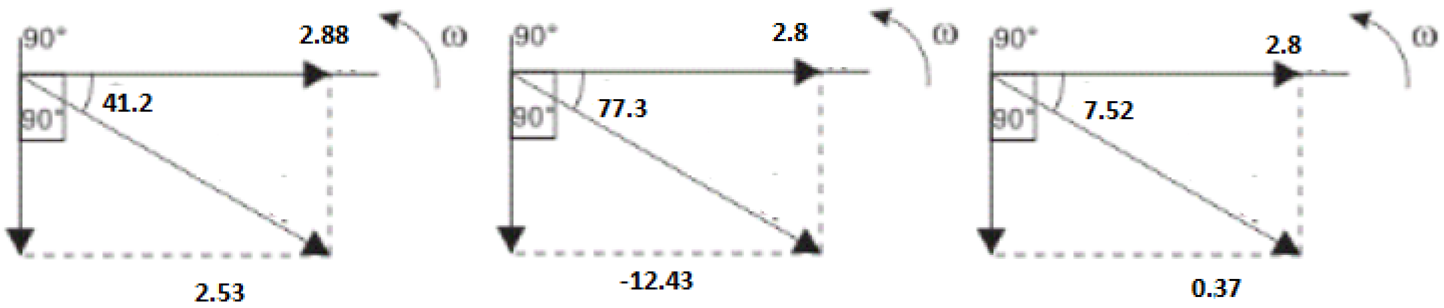
And to find the phase angle, we use the following equation:

$$\tan \Phi = \frac{Ic - IL}{Ir}$$

- Φ(0.1μF)=41.2
- Φ(0.22μF)=7.52
- Φ(1μF)=77.3

✓ The Fig below shows the victor digram in parallel C.





0.1μF
Itot=3.83mA

0.22μF
Itot=2.82mA

1μF
Itot=12.47mA

Conclusion

We learned about RLC circuits and we knew that the phase shift between current and voltage in these circuits depends on the impedance Z.

- When the impedance is pure resistive, the current and voltage are both in phase.
- When the impedance is inductive resistive, the voltage leads the current.
- When the impedance is capacitive resistive, the current leads the voltage