Feng Chia University

Electrical Engineering Fundamentals II Lab

Laboratory 4

AC RC Circuits and Phasor

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I. Introduction

a. To observe the RC Circuits and Phasor under Alternative Current

II. Materials

a. Waveform Generator

b. Digital Oscilloscope

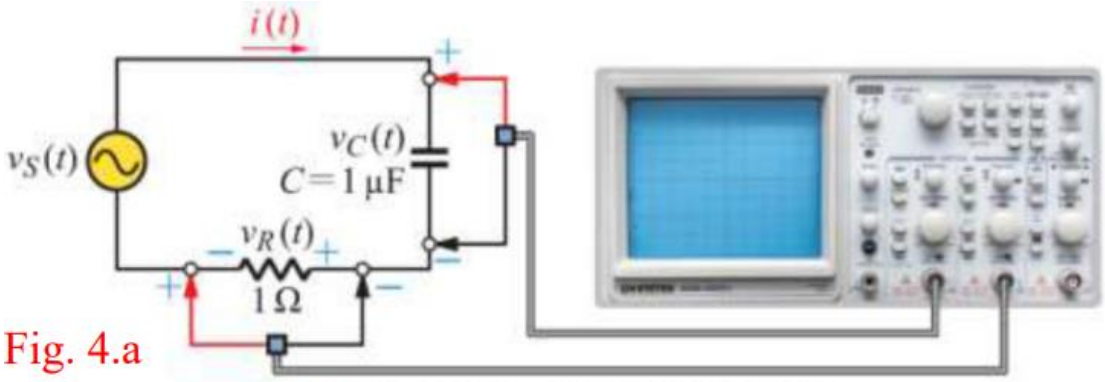
c. Digital Multimeter

d. Devices

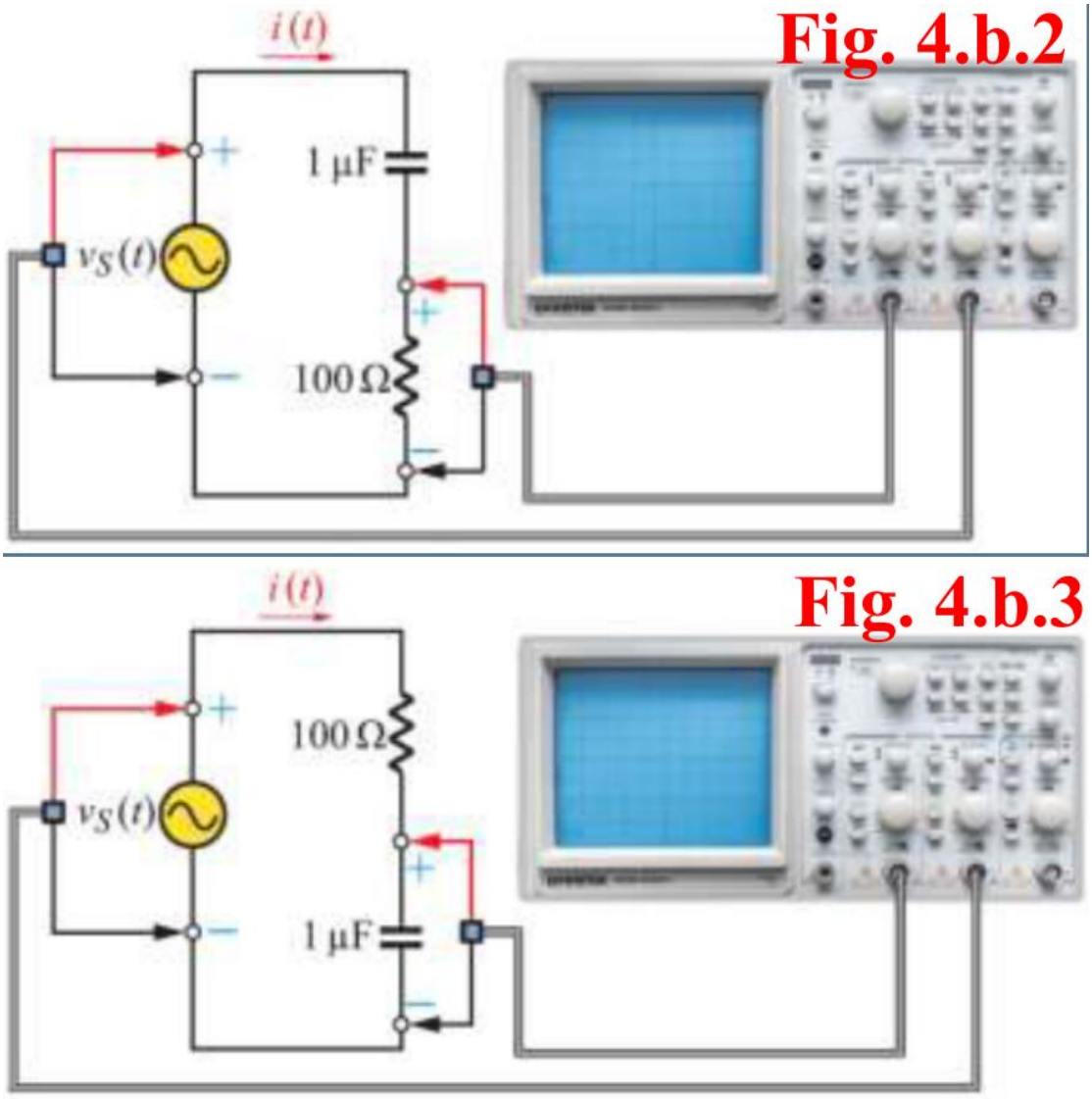
Resistors: R = 1 Ω, 10 Ω, 100 Ω, 1kΩ

Capacitor: C = 1 μF

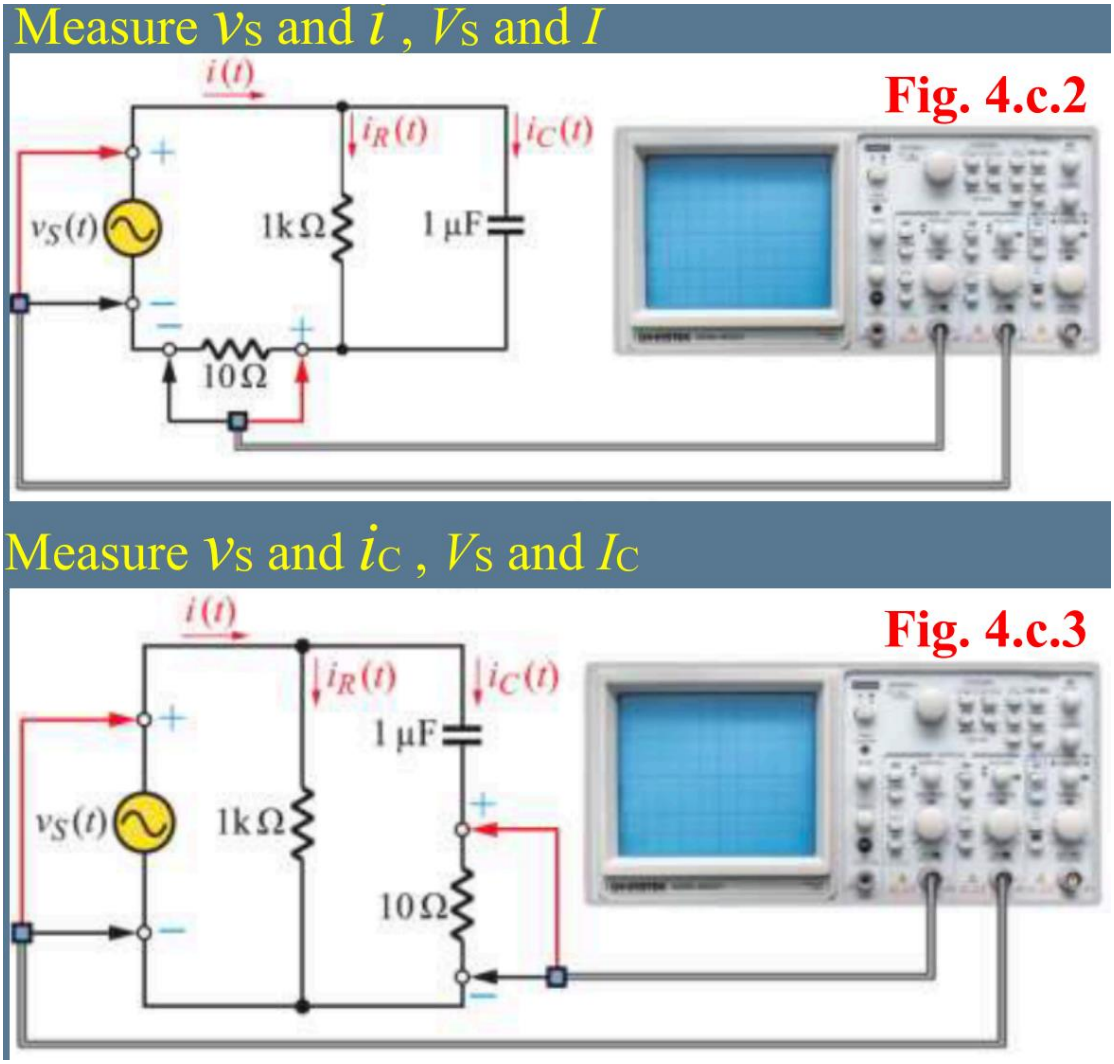
III. Circuit diagram



▲ Figure 1. Circuit of Experiment 4.a Pure Capacitive AC Circuit



▲ Figure 2. Circuit of Experiment 4.b RC Series Circuit



▲ Figure 3. Circuit of Experiment 4.c RC Parallel Circuit

IV. Methods

Using Digital Multimeter to observe current and voltage and Oscilloscope to observe the wave.

V. Experiments data

a. Experiment 4.a Pure Capacitive AC Circuit

Table 1: Measurement of Pure Capacitive AC Circuit

f	X_C	I		θ
		Theoretical	Measurement	
100 Hz	1591.5 Ω	0.889 mA	0.923 mA	1.62°
500 Hz	318.3 Ω	4.443 mA	4.425 mA	-90.05°
1 kHz	159.2 Ω	8.886 mA	8.324 mA	-90.24°
10 kHz	15.9 Ω	88.858 mA	23.062 mA	-120.79°

b. Experiment 4.b RC Series Circuit

Table 2: Measurement of RC Series Circuit

	V_S	V_R	V_C	I
Theoretical	1.414 V	0.7072 V	1.224 V	7.071 mA
Measurement	1.2347 V	0.5983 V	1.0494 V	6.024 mA

	X_C	Z	I leads V_S by
Theoretical	173.1087 Ω	199.9802 Ω	59.9806°
Measurement	174.1999 Ω	204.963479 Ω	57.6°

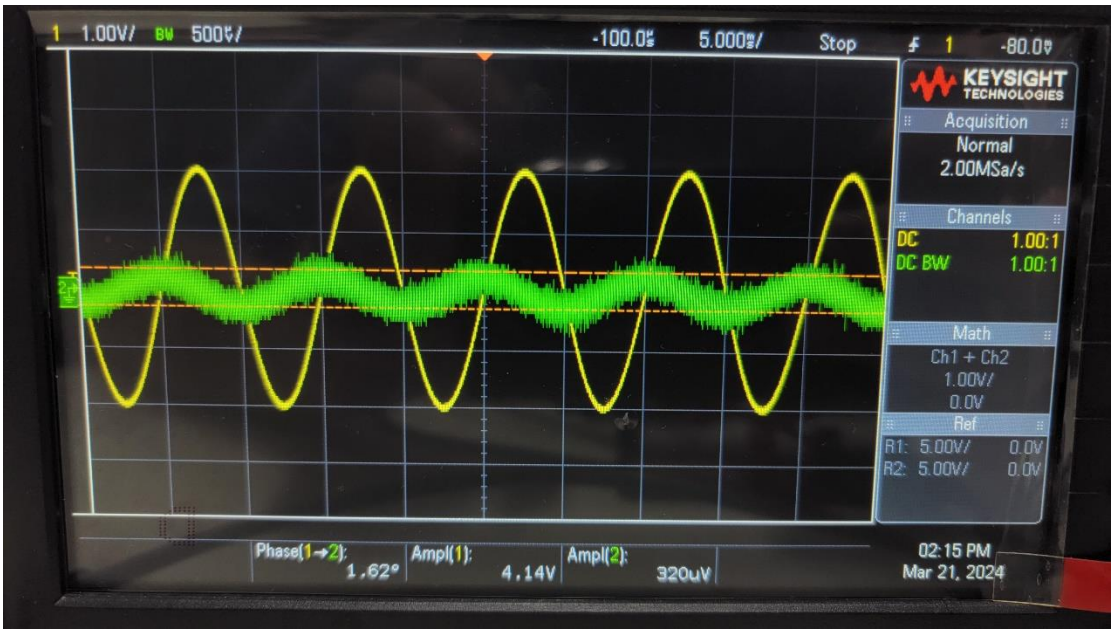
c. Experiment 4.c RC Parallel Circuit

Table 3: Measurement of RC Parallel Circuit

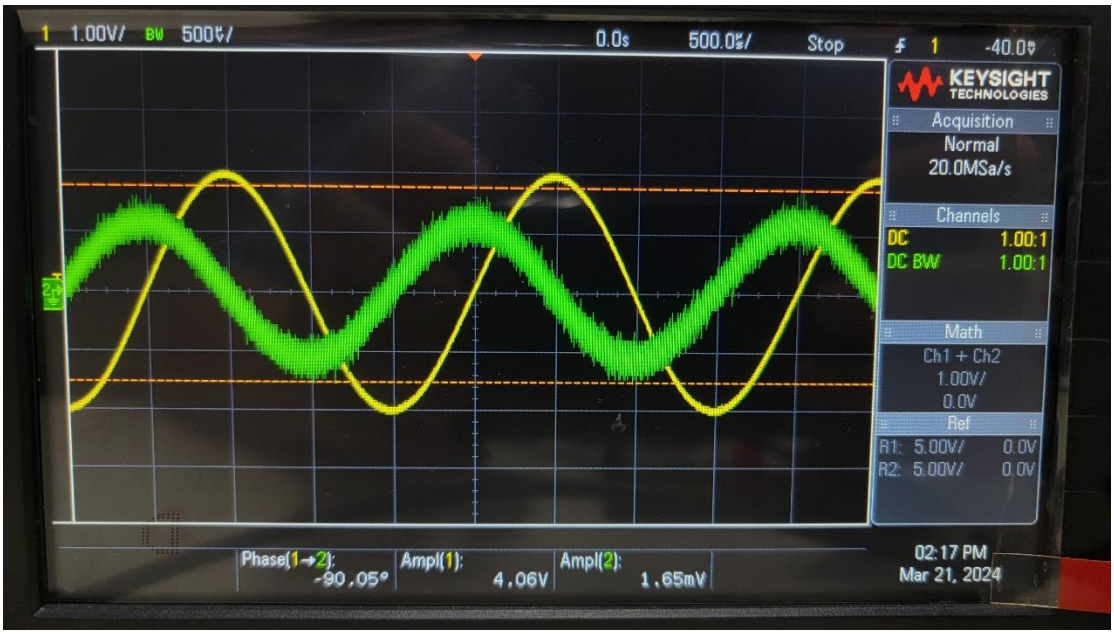
	V_S	X_C	Z	I leads V_S by
Theoretical	3 V	750.7508 Ω	600.4804 Ω	53.1033°
Measurement	2.8563 V	731.8217 Ω	581.0212 Ω	111.8°

	I	I_R	I_C
Theoretical	4.996 mA	3 mA	3.996 mA
Measurement	4.916 mA	2.893 mA	3.903 mA

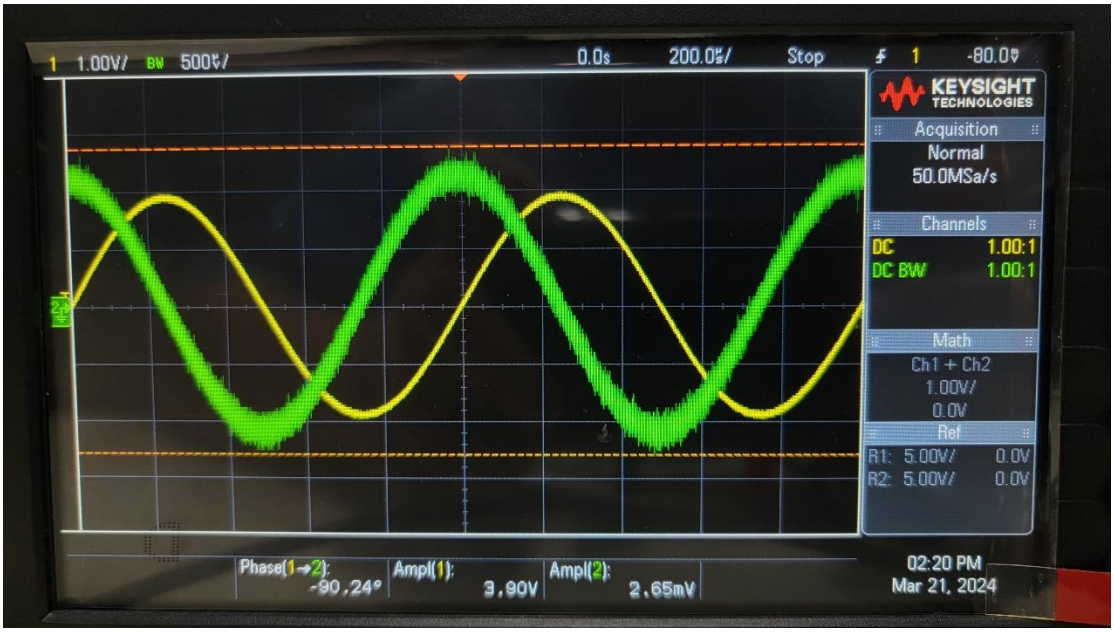
VI. Results



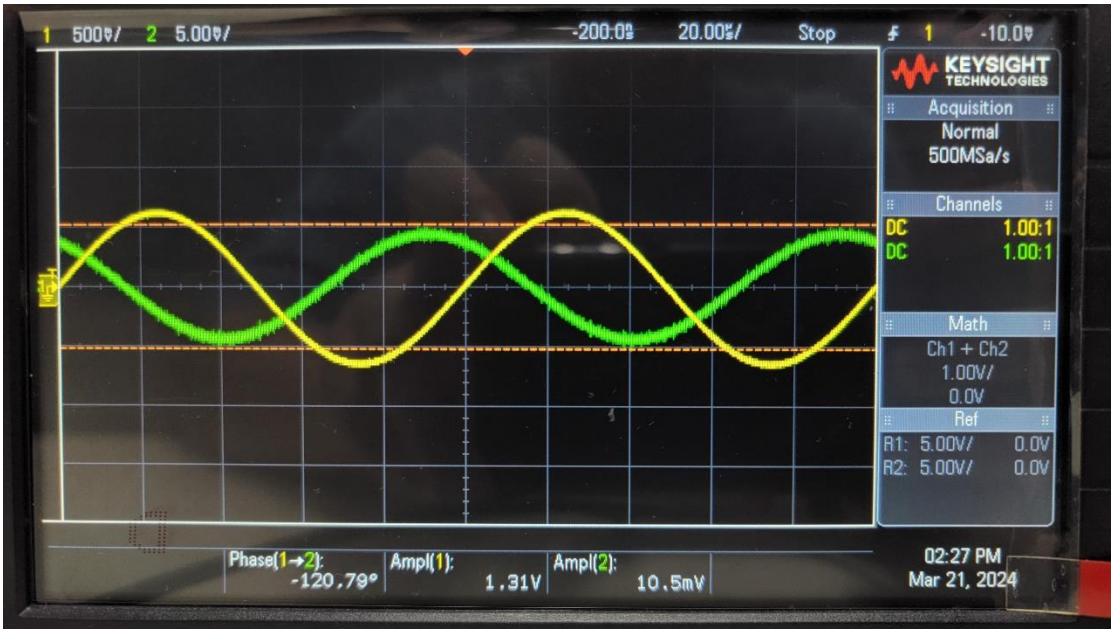
▲ Figure 4. Results of Experiment 4.a 100 Hz



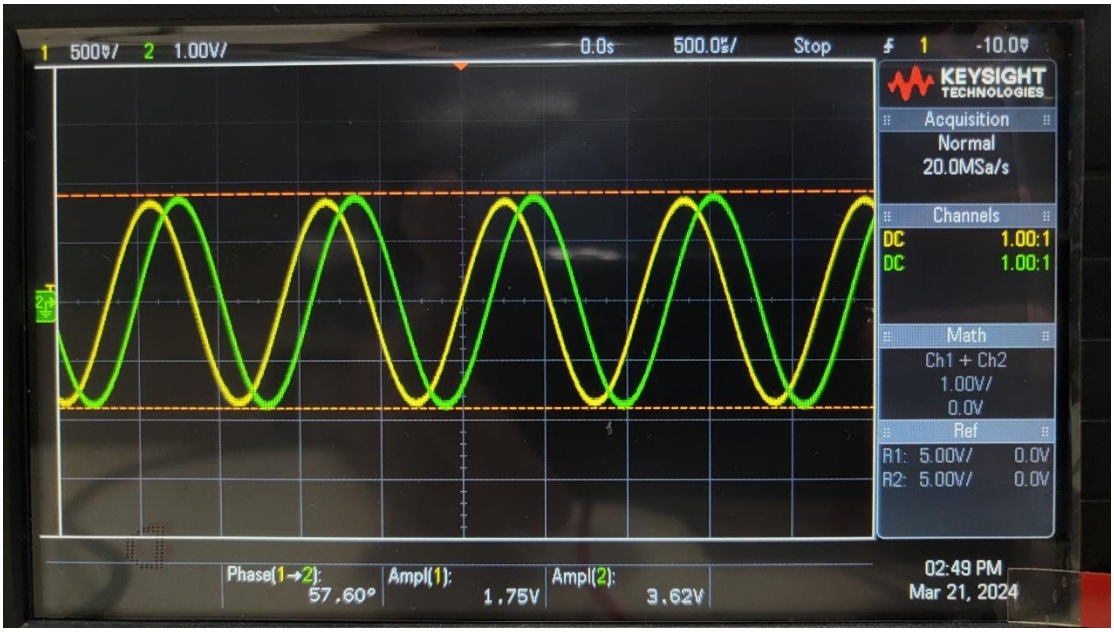
▲ Figure 5. Results of Experiment 4.a 500 Hz



▲ Figure 6. Results of Experiment 4.a 1 kHz

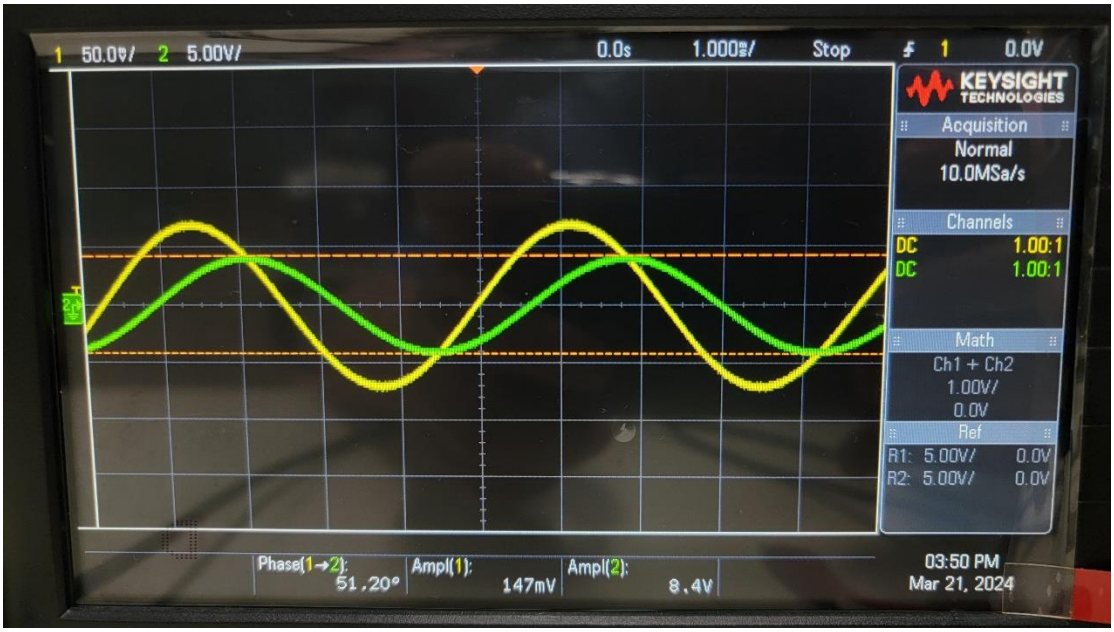


▲ Figure 7. Results of Experiment 4.a 10 kHz

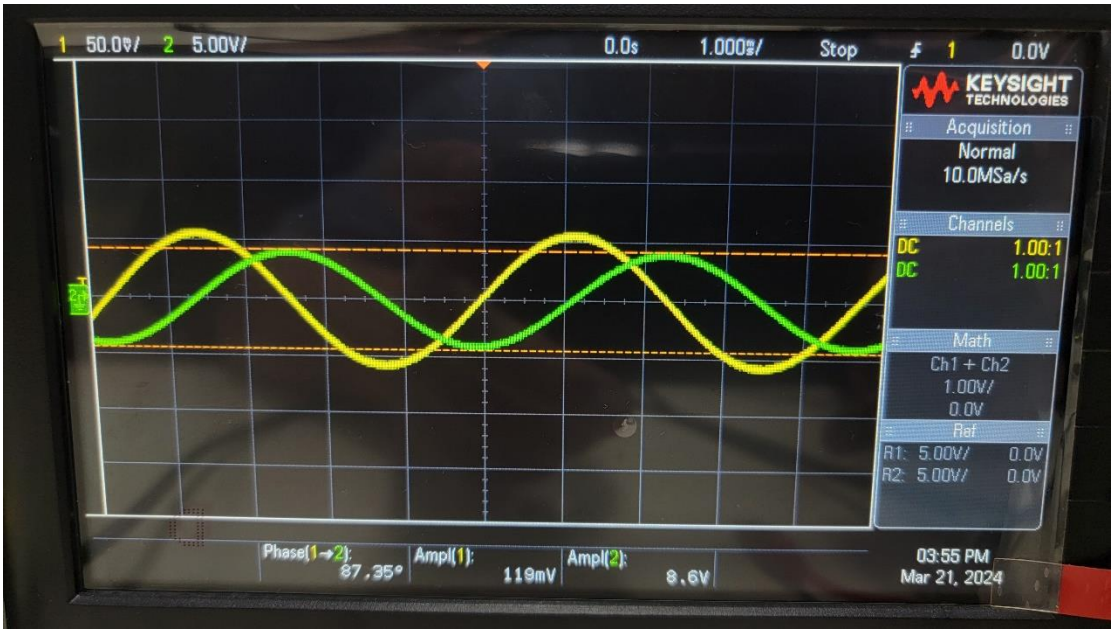


▲ Figure 8. Results of Experiment 4.b.2

▲ Figure 9. Results of Experiment 4.b.3



▲ Figure 10. Results of Experiment 4.c.2



▲ Figure 11. Results of Experiment 4.c.3

VII. Discussion

Explain why the phase lead between current and voltage for the capacitor is not 90°?

Because of the impedance and resistance involved, the phase lead will not be exact 90°. But the higher the frequency is, the phase lead will be more close to 90°.

VIII. Conclusion

From the graphs above, current will lead voltage.