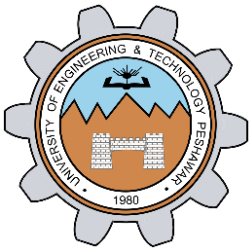
LAB # 2



CSE-203L Circuit & Systems-II Lab

Fall 2022

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"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: _____

Submitted to:

Engr. Faiz Ullah

20th October, 2022

Department of Computer Systems Engineering

TITLE:

Capacitive Reactance

OBJECTIVES:

- To learn the basic concept of capacitive reactance of a capacitor.
- To investigate the relationship capacitance and frequency.
- To plot a graph of capacitive reactance versus frequency.

APPARATUS:

- Oscilloscope
- AC Function Generator

COMPONENTS:

- 1 µF Capacitor
- 2.2 µF Capacitor
- 10k Ω Resistor

CAPACITOR:

A capacitor is a device used to store electrical energy.

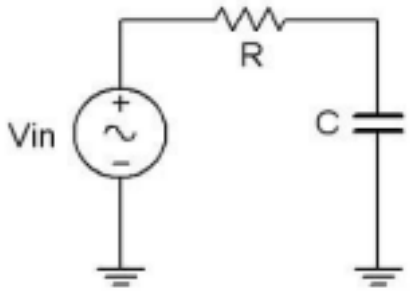
CAPACITOR PROPERTIES:

- The **Capacitance** of a capacitor determines the amount of charging a capacitor can achieve.
- The **Capacitive Reactance** is measure of the opposition to alternating current by the capacitor is called **Capacitive Reactance.**

MATHEMATICAL FORM:.

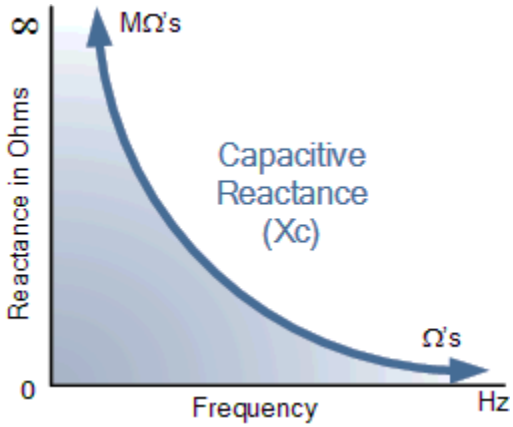
$$X_c = \frac{1}{2\pi f C}$$

BASIC CIRCUIT:



PLOT AGAINST FREQUENCY:

Plot of Capacitive Reactance against Frequency is given below.



By re-arranging the reactance formula above, we can also find at what frequency a capacitor will have a particular capacitive reactance (XC) value.

PROCEDURE:

1. First of all, I connected a resistor (10KΩ) in series with a capacitor of 1 µF and applied 10V across them.
2. Then I connected probe 1 and probe 2 of the oscilloscope with the resistor and capacitor respectively.
3. I theoretically calculated the value of Capacitive Reactance using the formula:

$$X_c = \frac{1}{2\pi f C}$$

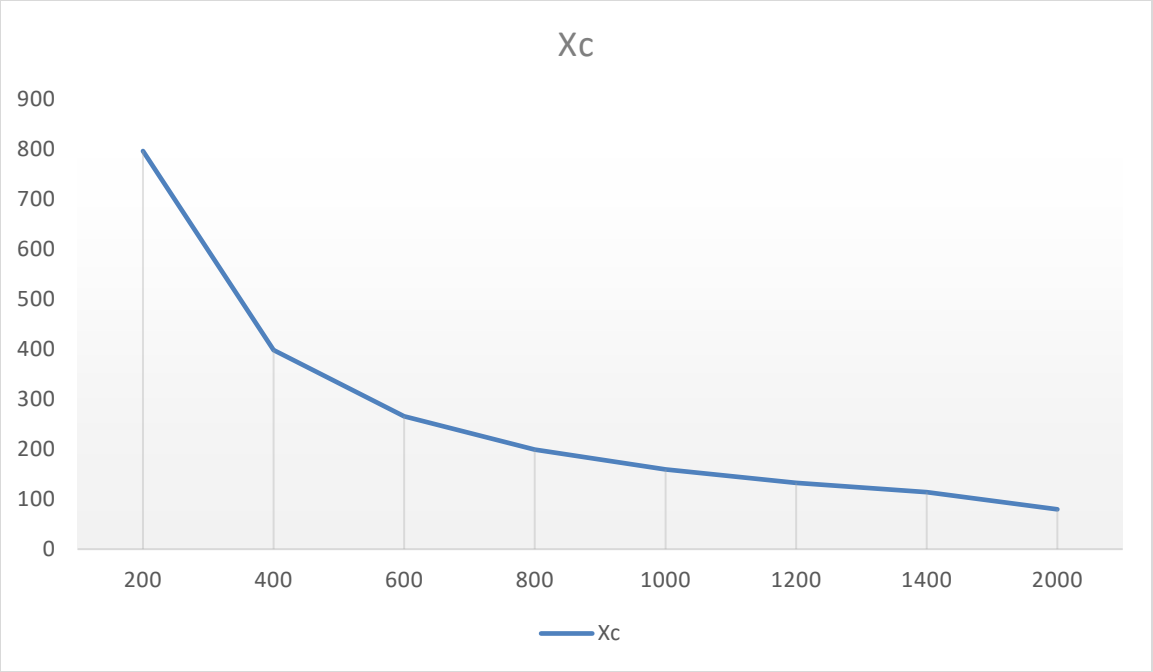
4. Then I calculated current in the circuit using Ohm's Law.
5. After that, I set the input frequency at 200 Hz in function generator. I calculated $V_{P\text{-}P}$ from the oscilloscope by multiplying the **number of divisions between two peak values** with the **volts per division**.
6. Then I calculated experimental value of Xc using Ohm's Law:

$$Xc = \frac{V_{p-p}}{I}$$

OBSERVATIONS AND RESULTS:

For C = 1µF:

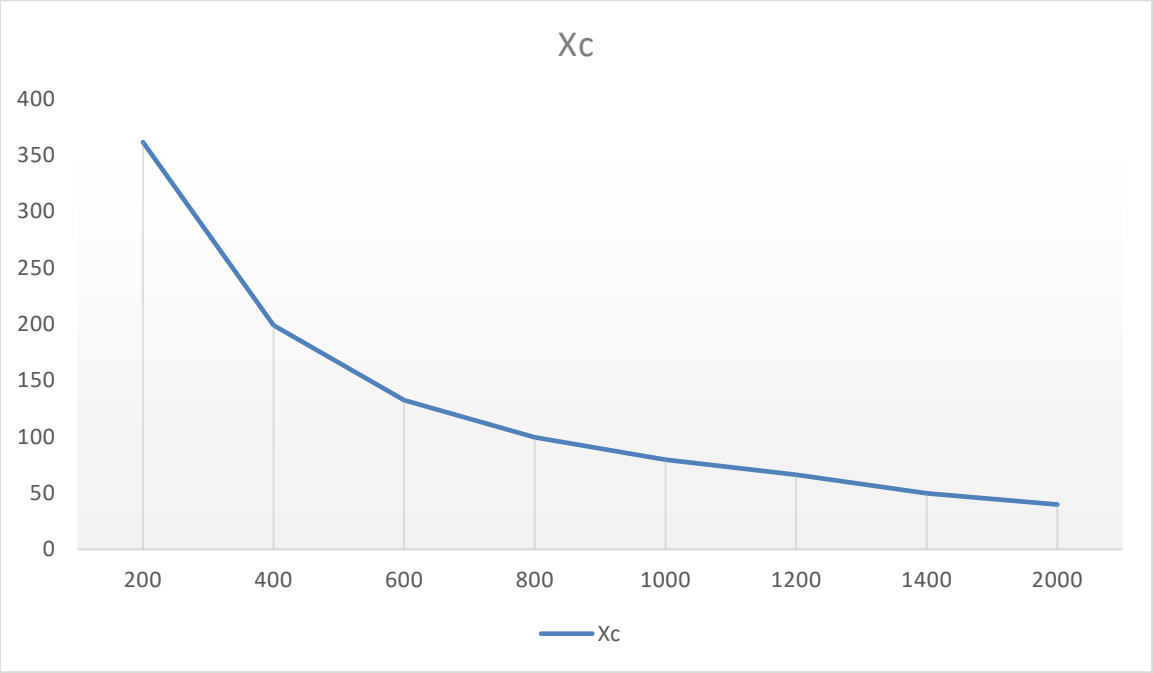
Frequency	Xc Theory	$Vc_{(P\text{-}P)}$ Exp	Xc Exp	%Dev
200	795.77 Ω	0.80 V	800 Ω	0.528%
400	397.88 Ω	0.40 V	400 Ω	0.530%
600	265.26 Ω	0.27 V	270 Ω	1.750%
800	198.94 Ω	0.20 V	200 Ω	0.530%
1.0K	159.15 Ω	0.16 V	160 Ω	0.530%
1.2K	132.63 Ω	0.135 V	135 Ω	1.750%
1.4K	113.68 Ω	0.11 V	110 Ω	3.230%
2.0K	79.57 Ω	0.08 V	80 Ω	0.530%



For C = 2.2µF:

Frequency	Xc Theory	$Vc_{(P-P)}$ Exp	Xc Exp	%Dev
200	361.715 Ω	0.350 V	350 Ω	3.23 %
400	198.943 Ω	0.190 V	190 Ω	4.49 %
600	132.629 Ω	0.128 V	128 Ω	3.49 %
800	99.471 Ω	0.096 V	96 Ω	3.49 %
1.0K	79.577 Ω	0.078 V	78 Ω	1.98 %
1.2K	66.314 Ω	0.066 V	66 Ω	0.47 %
1.6K	49.735 Ω	0.048 V	48 Ω	3.48 %

2.0K	39.788 Ω	0.039 V	39 Ω	1.98 %



CONCLUSION:

From this experiment, we concluded that **Capacitive Reactance** is inversely proportional to the input **frequency of AC current** and **Capacitance** of the **Capacitor**.