Practical No. 4: Observe the phase difference between voltage and current on CRO for resistive, inductive, and capacitive load and comment on the nature of the power factor (Lagging, Leading, and Unity).

I Practical Significance:

Phase difference between voltage and current in a circuit depends on parameters of the circuit. Based on this, circuit has lagging, leading or unity power factor.

II Industry/Employer Expected Outcome(s)

Use electrical equipment efficiently for different electronic engineering application.

III Course Level Learning Outcome(s)

Analyze A.C. circuits for single phase and polyphase supply.

IV Laboratory Learning Outcome(s)

LLO Identify phase angle and phase difference of given quantities.

LLO Identify the nature of power factor for the respective circuit.

V Relevant Affective Domain related outcome(s)

Follow safety electrical rules for safe practices.

VI Relevant Theoretical Background

The phase difference or phase shift as it is also called of a sinusoidal waveform is the angle Φ (Greek letter Phi), in degrees or radians that the waveform has shifted from a certain reference point along the horizontal zero axis. In other words phase shift is the lateral difference between two or more waveform along a common axis and sinusoidal waveforms of the same frequency can have a phase difference.

The phase difference Φ of an alternating waveform can vary between 0 to its maximum timer period T of the waveform during one complete cycle and this can be anywhere along the horizontal axis between Φ = 0 to 2π or Φ = 0 to 360° depending upon the angular units used.

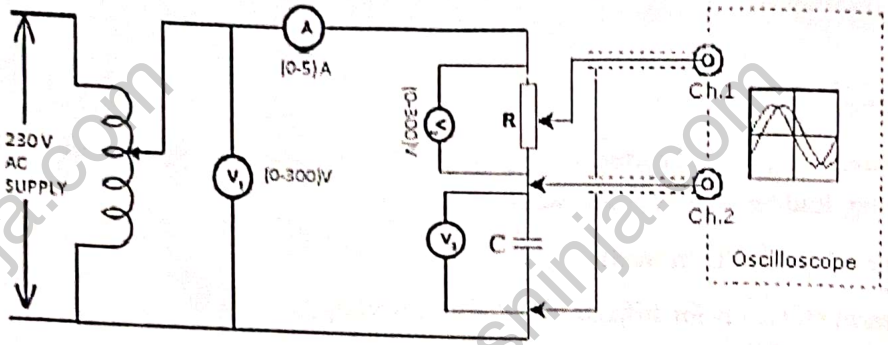
Then the equation for the instantaneous value of a sinusoidal current and voltage waveform

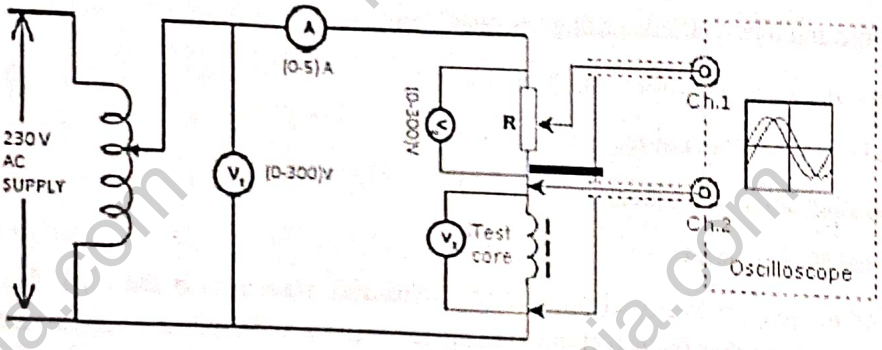
pure resistive circuits are $i = Im * sinmt$ and $v = Vm * sinmt$

for pure inductive circuit are $v = Vm * sinmt$ and $i = Im * sin(mt - 90)$

for pure capacitive circuit $v = Vm * sinmt$ and $i = Im * sin(mt + 90)$

VII Actual Circuit diagram used in laboratory with equipment Specifications:





VIII Required Resources/apparatus/equipment with specification:

S. No.	Name of Resource	Suggested Broad Specification	Quantit
1	Rheostat	Suitable Rheostat	1
2	Inductor	Suitable Inductor	1
3	Capacitor	Suitable Capacitor	1
4	Voltmeter	Suitable Voltmeter	1
5	Ammeter	Suitable Ammeter	1
6	CRO	With 2 attenuator probes	1

IX Precautions to be followed:

1. All electrical connections should be neat and tight.
2. Check the power supply before connection.
3. Connect ammeter in series.
4. Connect voltmeter in parallel.
5. Do not give high voltage to CRO.

X Procedure

1. Connect the circuit as per circuit diagram.
2. Connect the CRO for observing current and voltage waveform.
3. Repeat step 2 for different input voltages.
4. Plot the waveform.

XI Required Resources/apparatus/equipment with specification:

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Rheostal	Suitable Rheostal	1
2	Inductor	Suitable inducter	1
3	Capaciter	Suitable Capaciter	1
4	Voltmeter	Suitable Voltmeter	1
5	Ammeter	Suitable Ammeter	1
6	CRO.	Suitable CRO	1.

XII Actual Procedure followed:

1. Connect the circuit as per circuit diagram
2. Connect the CRO for observing current and voltage waveform
3. Repeat ~~after~~ Step 2 for different input voltage
4. Plot the waveform

XIII Observations and calculations

Sr. No.	Supply voltage (V1)	Voltage across Resistance (V2)	Voltage across Inductor (V3) **OR** Voltage across Capacitor (V3)	Current (
1	137 V	112 V	130 V	1.3 A
2	190 V	115 V	125 V	1.5 A
3	200 V	120 V	140	1.9 A

XIV Results:

Hence this practical conclude that observe the pha different voltage current of CRO for resistive inductive and capacitive load

XV Interpretation of results:

Hence this practical conclude that observe the phase different voltage current of CRO for resistive inductive and capacitive load

XVI Conclusion and recommendation

Hence this practical conclude that observe the phase different voltage current of CRO for resistive induc e and capacitive load

XVII Practical related questions (Provide space for answers)

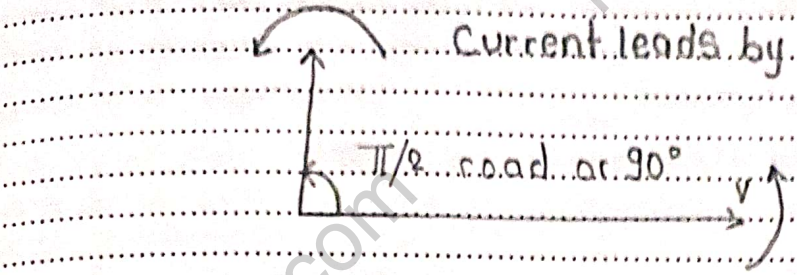
1. Give current, voltage relation in R, L, C element.
2. Draw phasor diagram showing relation between V1, V2 and V3.
3. Obtain phase different between supply voltage and current for setup given.
4. Calculate power factor of the circuit.

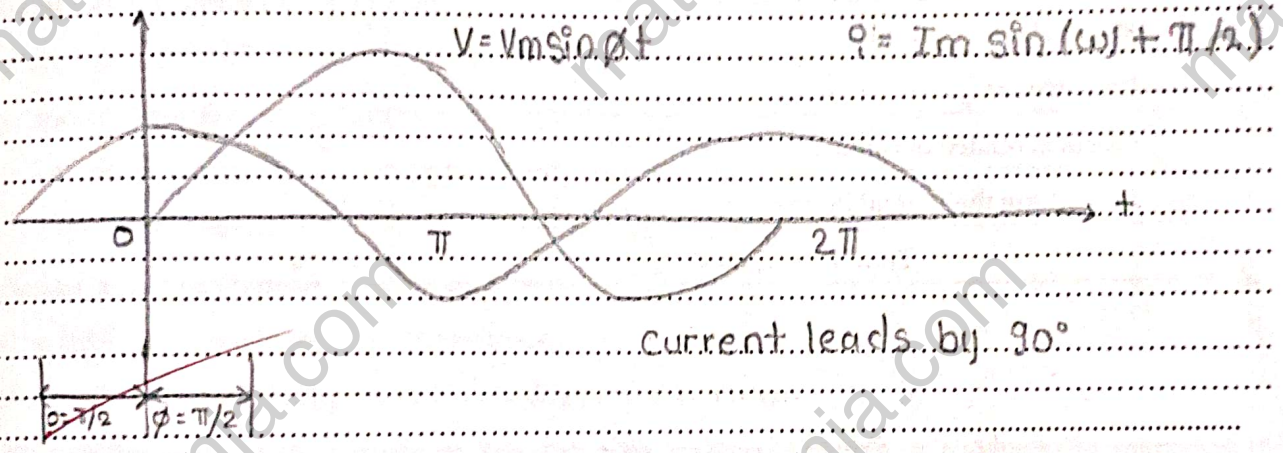
$V = \sqrt{V_1^2 + V_2^2}$

$V = \sqrt{(137)^2 + (112)^2} = 176.96$

$R = \frac{V_R}{I} = \frac{112}{1.3} = 86.15$

$= \frac{V}{I} = \frac{137}{1.3} = 105.38$





XVIII References/Suggestions for further reading:

1. www.electrical4u.com
2. www.howstuffworks.com
3. www.electricaltechnology.org