Experiment no.-1

Name: KCL and KVL verification.

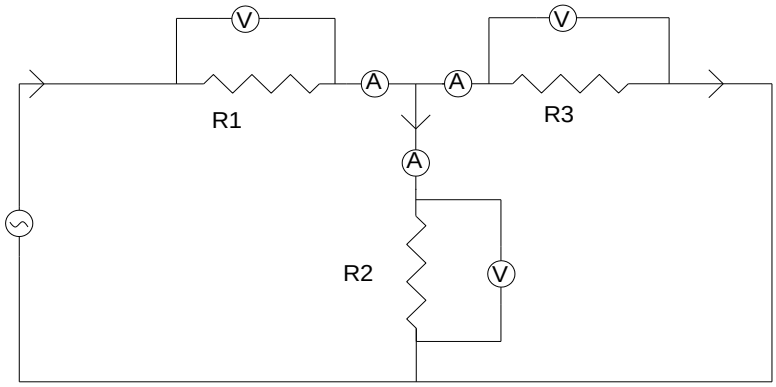
Objective:

To verify KCL & KVL for a given electrical circuit.

Apparatus:

1. DC ammeter (0-2A,0-1A)
2. DC voltmeter(0-50V)

Experimental setup:



Observation table:

sr.no. | I_1 | I_2 | I_3 | V_1 | V_2 | V_3 |

Procedure:

1. Tabulate all the measured values.
2. Plot all measured quantities as V-I characteristics of different elements.

Experimental quiz:

1. Why do you prefer to use linear elements in a network?
2. From the graphical plot, find the resistance at different voltage.

Experiment No. 2

Name: Measurement of Low and High resistance of dc shunt motor

Objective:

(a) To measure low resistance of armature winding by voltmeter ammeter method

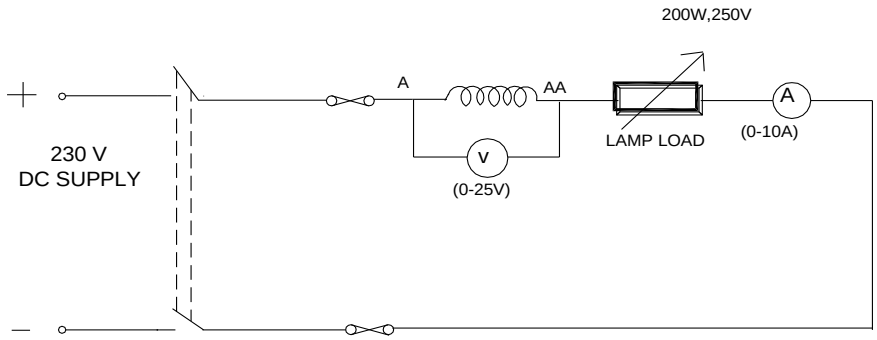
(b) To measure high resistance (shunt field winding of a dc machine) by ammeter Voltmeter method.

Apparatus:

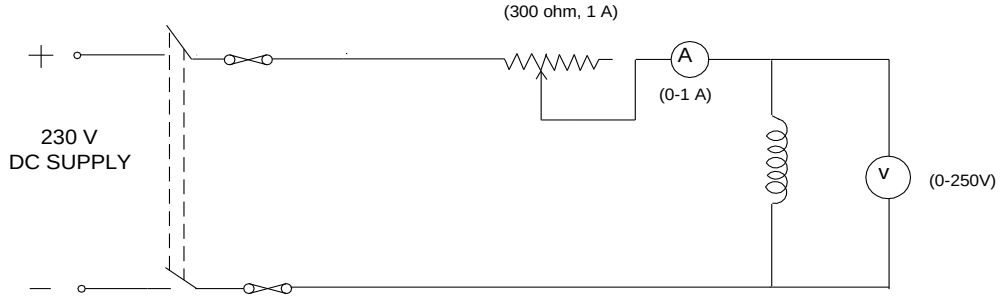
DC voltmeter (0-25V) and (0-250V),
DC ammeter, (0-1, 0-15 A)
1-phase lamp load(200W,250V)
Rheostat (300Ω, 1A)

Experimental Setup:

MEASUREMENT OF LOW RESISTANCE OF ARMATURE WINDING



MEASUREMENT OF HIGH RESISTANCE OF SHUNT FIELD WINDING



Observation Table:

Sr.No.	V	I	R=V/I	Average R

Procedure:

Graphically plot V-I characteristic for both setup.

Experimental Quiz:

1) Can a lamp-load be replaced by a rheostat or vice versa for the two parts of the experiment?
2) Determine the resistance from the plot at different voltages.

Experiment No. -3

Name- AC R-L-C series circuit.

Objective:

a) To obtain the current and voltage distribution in AC R-L-C Series circuit.
b) To draw the phasor digram.

Apparatus :

1-phase auto transformer.
Rheostat(200Ω,1.8A)
Choke coil (4H)
Capacitor(4 μF)
AC ammeter(0-3 A)
AC voltmeter(0-40, 0-250V)

Theory:

The basic VI relationships of resistance,inductance and capacitance are given by

i) $V_R=R*I_R$
ii) $V_L= L\ di/dt$
iii) $V_C=1/c \int ic\ dt$

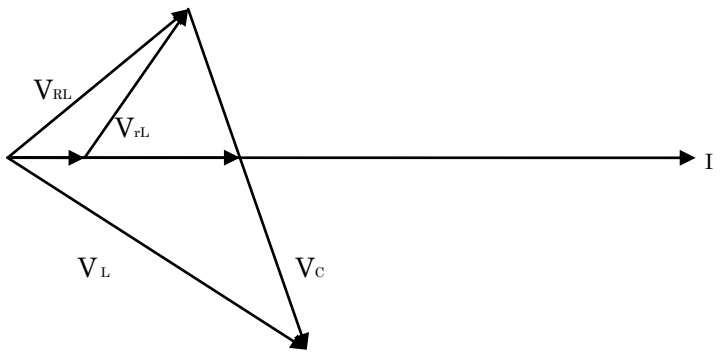
And

$V_R= R\ Im \sin wt$

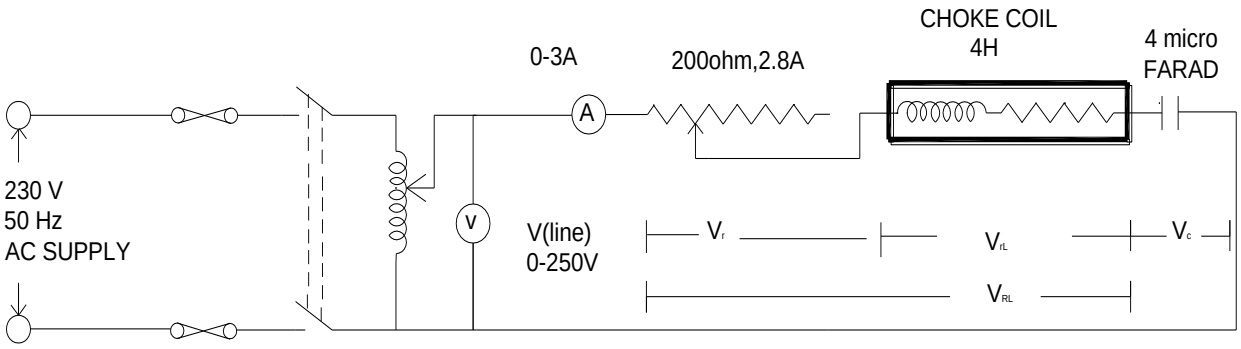
$V_L= wL\ Im \cos wt= wLIm \sin(wt+90)$

$V_C= (1/wc)\ Im \cos wt= (1/wc)\ Im \sin(wt-90)$

It can be concluded that the voltage across a resistance is in phase with the current through it,the voltage aross inductance leads the current by 90 degree and the voltages across a capacitance lags by 90 degree. The phase relations can be conventionally expressed in a phasor digram given below(in ideal case).



Experimental Setup:



Observation Table:

Sr.No. | I | V_{Line} | V_R | V_{rl} | V_{RL} | V_c

Experimental Quiz :

1) In the case of an inductor, whatwill be the shape of volt/ampere versus frequency curve?
2) What is the maximum power available from the power supply which you have used ?
3) In a series RC circuit, write down an expression for the voltage across the capacitor in terms of the total voltage and the voltage across the resistance.
4) In a series RLC circuit, determine expression for the current in (I) resistor R(II) Capacitor C and (III) inductor L.
5) How can you obtain the critically damped response in a series RLC circuit where R and C are variable and the inductance L has a fixed value?

Experiment No.4

Name:- **AC R-L-C parallel circuit.**

Objective:

a) To obtain the current and the voltage distribution in AC R-L-C parallel circuit.
b) To draw the phasor digram

Apparatus :

1-phase auto transformer.

Rheostat (200Ω, 2.8A)

Choke coil (4H)

Capacitor(4μF)

AC ammeter (0-3,0-1,0-10A)

AC voltmeter (0-250V)

Theory:

The basic VI relationship of resistance, inductance and capacitance are given by

i) $I_R = V_R/R$
ii) $I_L = (1/L)\int V_L\, dt$
iii) $I_c = C\, dVc/dt$

And, when the voltage across each element is V= Vm sinwt, the currents are given by

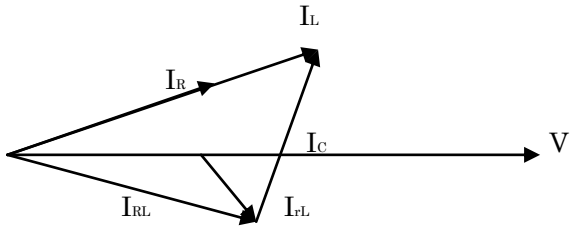
$I_R = (1/R)Vm\ \sin wt$

$I_L = (1/wL)\ Vm\ \cos wt$

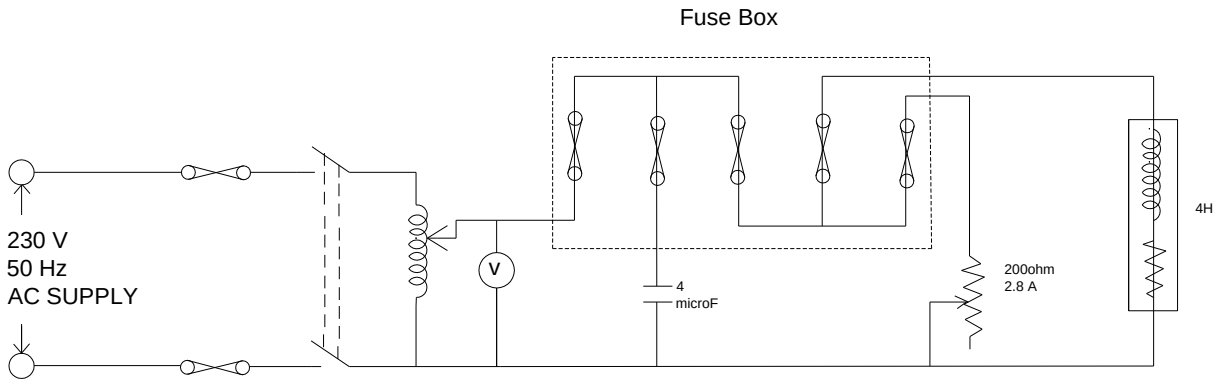
$I_c = wc\ Vm\ \sin(wt+90)$

It can be concluded that , the current in a resistance is in phase with the voltage across it, the current in an inductance lags the voltage by 90 and the current in a capacitor leads by 90.

The phase relations can be conventionally expressed in a phasor digram given below (in ideal case)



Experimental Setup:



Observation Table:

S.No. | V | I_{LINE} | I_R | I_{rL} | I_{RL} | I_C |

Experimental Quiz:

1) What do you understand by inductance of a coil? What is an iron cored coil ? what is an air cored coil?
2) What will be the effect on inductance on a increase in the no. of terms of a coil?
3) How is the rating of a coil and a capacitance specified ?
4) What are the different types of capacitance commonly used?
5) What is the resistance of 4H choke whose impedance at 50Hz has magnitude of 750Ω, what is the angle of impedance?

Experiment No. 5

Name: 3-Voltmeter method

Objective:

a) To measure the power and the power factor of a single phase load by 3-voltmeter method
b) To draw phasor digram

Apparatus:

1-phase auto transformer,

Rheostat(200Ω, 2.8A)

Choke coil(4H)

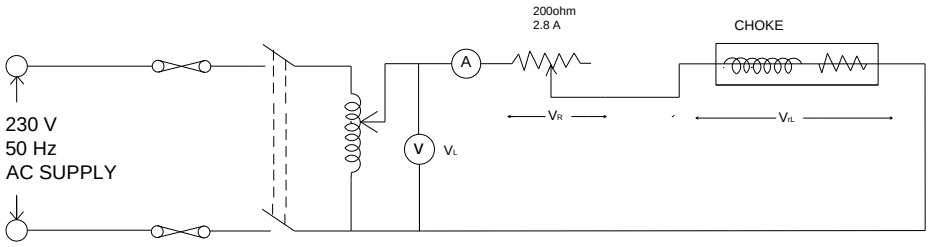
AC ammeter (0-3A)

AC voltmeter (0-250, 0-40V)

Theory :

The single phase load under consideration is a choke coil. In this method, a known resistance in connected in series with the choke and a.c voltages is applied to the combination. The voltage across the choke, resistance and the supply are measured. The voltage across the resistance gives the value of current and the vector diagram shown below can be obtained .

Experimental Setup:



Observation Table:

S. No. | V_{Line} | I_{Line} | V_R | V_{rL} |

Experimental Quiz:

1) In the case of an inductor, what will be the shape of volt/ampere versus frequency curve?
2) What is the max. power available from the power supply which you have used?
3) In a series RL circuit, write down an expression for the voltage across the inductor in terms of the total voltage and the voltage across the resistance.
4) In a series RL circuit, determined expression for current in(i) resistor R(ii) inductor L.
5) What is the power by this method, compare with wattmeter readings.

Experiment No.6

Name: 3-Ammeter method

Objective:

a) To measure the power and the power factor of a single phase load by 3 ammeter method.
b) To obtain the phasor diagram.

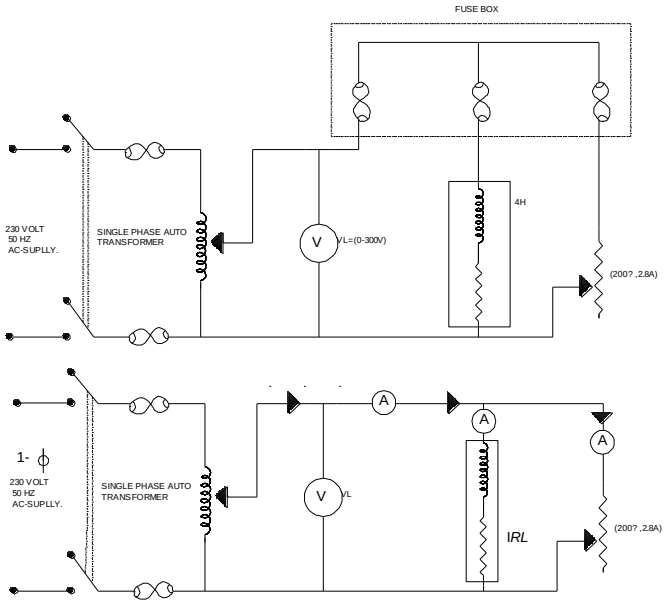
Apparatus:

1-phase auto transformer,
Rheostat(200Ω, 2.8 A)
Choke coil(4H)
AC Ammeter (0-3, 0-1A)
AC Voltmeter (0-250V)

Theory:

A known resistance is connected in parallel to the choke and the line current in the resistance give the supply voltage. The vector diagram can be obtained as shown and power and power factor can be calculated.

Experimental Setup:



Observation Table:

S.No. | V_{Line} | I_{Line} | I_R | I_{RL} |

Experimental Quiz:

1) What do you mean by inductance of coil? What is an iron cored coil? What is an air cored coil?
2) What will be the effect on inductance on a increase in the no. of terms of a coil?
3) How is the rating of a coil specified?
4) What is the resistance of 4H choke whose impedance at 50Hz has magnitude of 750Ω, what is the angle of impedance?

Experiment No. 7

Name: Study of resonance in electrical circuit.

Objective:

a) To find the condition of resonance in a AC RLC series circuit.
b) Draw the different phasor diagrams.

Apparatus:

AC ammeter(0-1A)

AC voltmeter (0-25V)

Sine wave generator

Theory:

$I_{max} = V/R$

$f_0 = 1/(2\pi\sqrt{(LC)})$

$Q = w_0L/R = 1/(w_0RC) = V_L$ or V_C/supply voltage

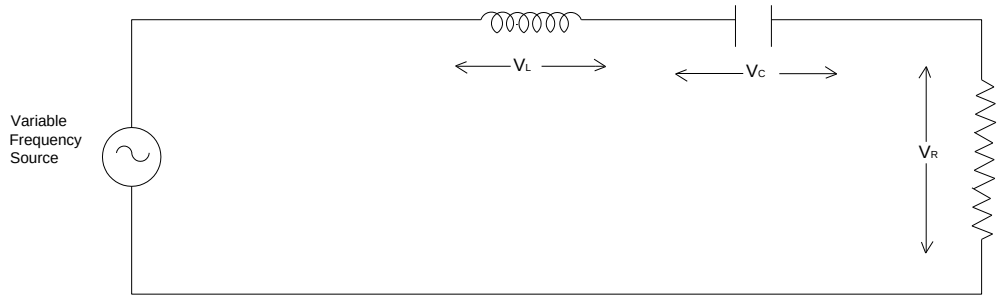
$W_o = 2\pi f_o$ where f_o is resonant frequency

Draw graph between current/voltage/impedance and frequency,

f_1, f_2 corresponds to $0.707I_{max}$

$Bw = f_1 - f_2 = R/2\pi L$

Experimental Setup:



Observation Table:

S.No.	I_L	V_p	V_L	V_L / V_p

Experimental Quiz:

1) If the load is unbalanced what will happen to the ratio and why?

Experiment No. 8

Name: 3-phase star connection

Objective:

a) To obtain the relation between line and phase quantity in 3-phase star connection.
b) To obtain the phasor diagram.

Apparatus:

3-phase auto transformer

AC ammeter(0-5A)

AC voltmeter(0-300,0-500 V)

3-phase lamp load(250V,200W)

Theory:

A balanced system of 3-phase voltages had the property that their voltages are same but differing in phase from one another by 120 degree.

$V_R = V_m \sin(wt)$

$V_Y = V_m \sin(wt-120^\circ)$

$V_B = V_m \sin(wt+120^\circ)$

When identical loads are connected in star in 3-phase supply the line currents and phase currents are same but the line voltages are given by

$V_{RY} = V_R - V_Y = \sqrt{3} V_m \sin(wt+30^\circ)$

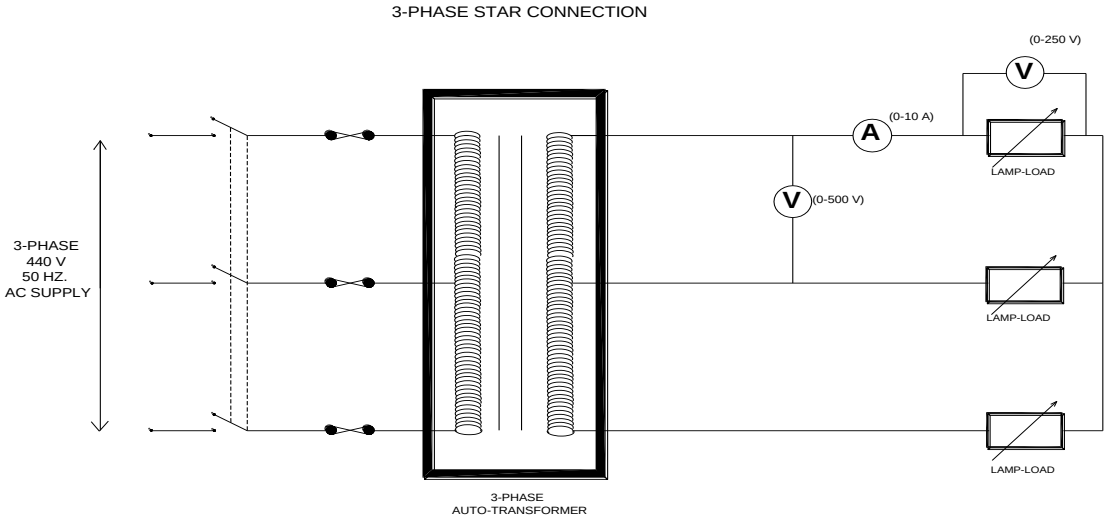
$V_{YB} = V_Y - V_B = \sqrt{3} V_m \sin(wt+30-120^\circ)$

$V_{BR} = V_B - V_R = \sqrt{3} V_m \sin(wt+30+120^\circ)$

Thus, the line current and the phase current are the same in star but the line voltage is √3 times of phase voltage.

Thus, the line voltage and the phase voltage are same in delta but line currents is√3 times of phase current.

Experimental setup:



Observation table:

s.no	Il	Ip	Vl	Il/Ip

Experimental Quiz:

1. If the load is unbalanced what will happen to the ratio and why?

Experiment No. 9

Name: 3-phase delta connection

Objective:

a) To obtain the relation between line and phase quantity in 3-phase delta connection.
b) To obtain the phasor diagram.

Apparatus:

3-phase auto transformer

AC ammeter(0-5A, 0-10A)

AC voltmeter(0-500 V)

3-phase lamp load(250V,200W)

Theory:

A balanced system of 3-phase currents had the property that their currents are same but differing in phase from one another by 120degree.

I_{RY}= Im sin wt

I_{YE}= Im sin (wt-120degree)

I_{BR}= Im sin (wt+120degree)

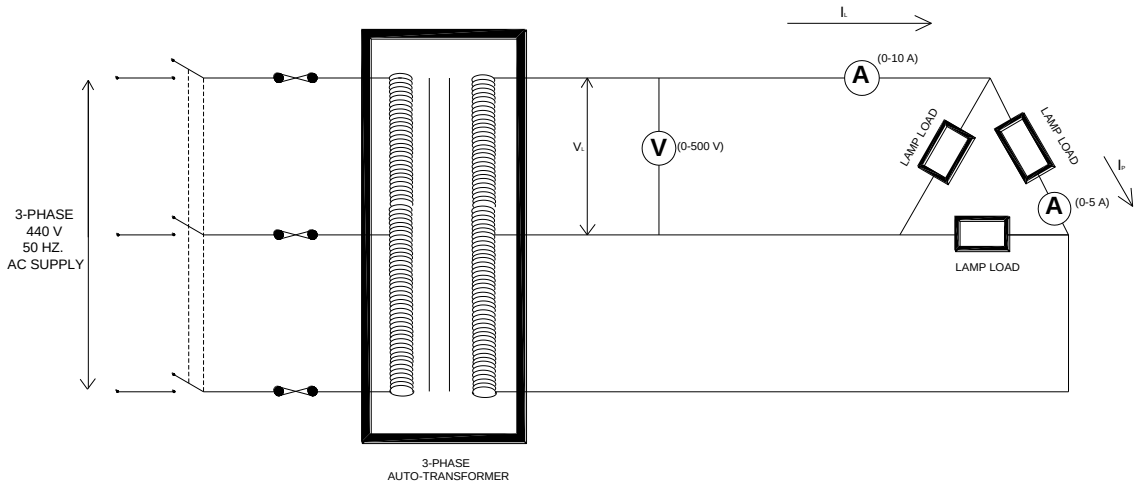
When identical loads are connected in delta in 3-phase supply the line voltage and phase voltage are same but the line current are given by

I_R=√3Im Sin(wt-30degree)

I_Y= √3Im Sin(wt-30-120degree)

I_B= √3Im Sin(wt-30+120degree)

Experimental Setup:



Observation table:

Sr.no. | f | I | Vl | Vc | calculated $I=V_R/R$ | calculated value of f_0

Experimental Quiz:

1) State the basic difference if any, between the resonance phenomenon in series and parallel RLC circuit.
2) The reactance offered by a parallel resonant circuit is zero/one/infinite.
3) The p.f. at resonance is 0.5/1/0
4) The resonant(max) value of current in aseries RLC ciruit is limited by the value of R/L/C of the circuit.
5) How is it that you get higher voltage at resonance across C(or L) than the applied voltage in a series resonance, explain
6) An RLC circuit has complex/purely resistive/purely reactive impedance.

Experiment No. 10

Name: **Measurement of 3-phase power**

Objective:

a) To measure the power input to 3-phase induction motor using two wattmeters
b) To obtain the phasor diagram

Apparatus:

2 Wattmeter (10A, 500V)
AC ammeter (0-10A)
AC voltmeter (0-500V)

Theory:

Suppose that the reading of the first wattmeter is W_1 and the second is W_2 given by

$W_1 = I_R * V_{RB} \cos \Phi$

$W_2 = I_Y * V_{YB} \cos \Phi$

Vector Diagram:

So, from the vector diagram obtained we have

$W_1 = \sqrt{3} V_{ph} * I_{ph} \cos(30^\circ - \Phi)$

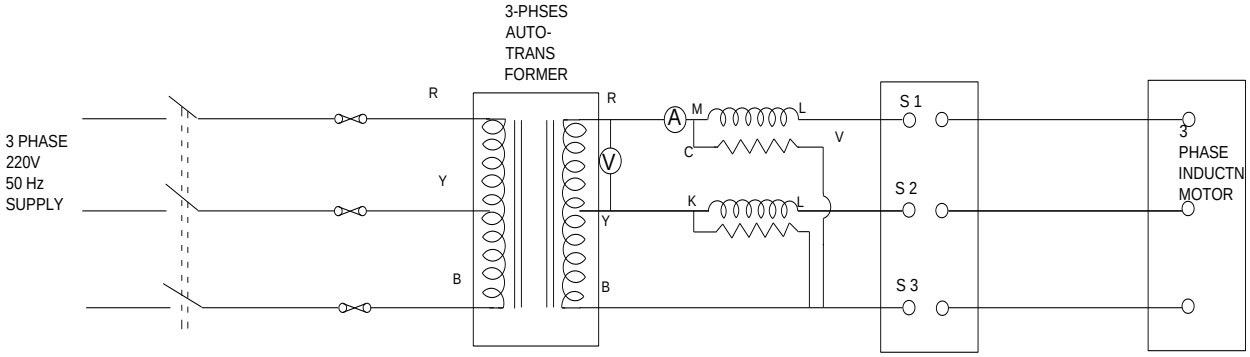
$W_2 = \sqrt{3}\ V_{ph} * I_{ph} \cos(30^\circ + \Phi)$

And $W_1 + W_2 = 3\, V_{ph} * I_{ph} \cos \Phi$

$= \sqrt{3}\, V_L * I_L \cos \Phi$

Again $(W_1+W_2)/(W_1-W_2) = \sqrt{3} \cot \Phi$

Experimental Setup:



Observation table:

Sr.No.	V	I	W_1	W_2	Φ	Power

Experimental Quiz:

1) Suppose the voltage and the current waveforms have different frequencies will be there be any average power.
2) Can one use an wattmeter as a voltmeter or a wattmeter as an ammeter? What is to be done in such case?
3) Suppose the voltage and current waveform have different frequencies, will there be any average power?