DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRIC CIRCUITS LABORATORY MANUAL

REGULATION – 2017

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PREFACE

This Laboratory manual for Electric Circuits Lab has been revised and updated in order to meet the Curriculum changes, laboratory equipment upgrading and the latest circuit simulation.

Every effort has been made to correct all the known errors, but nobody is perfect, if you find any additional errors or anything else you think is an error, Please feel free to inform the HOD / EEE at eeedept@avit.ac.in

The Authors thanked all the staff members from the department for their valuable Suggestions and contributions.

The Authors
Department of EEE

LIST OF EXPERIMENTS:

1. Verification of Ohm's Law
2. Verification of Kirchhoff's laws
3. Verification of Thevenin's Theorem
4. Verification of Norton's Theorem
5. Verification of Superposition theorem
6. Verification of Reciprocity theorem
7. Verification of Maximum Power Transfer theorem
8. Time Domain analysis of RL transient circuits
9. Time Domain analysis of RC transient circuits
10. Series Resonance Circuit
11. Parallel Resonance Circuit
12. Three Phase Power Measurement by Two Wattmeter method

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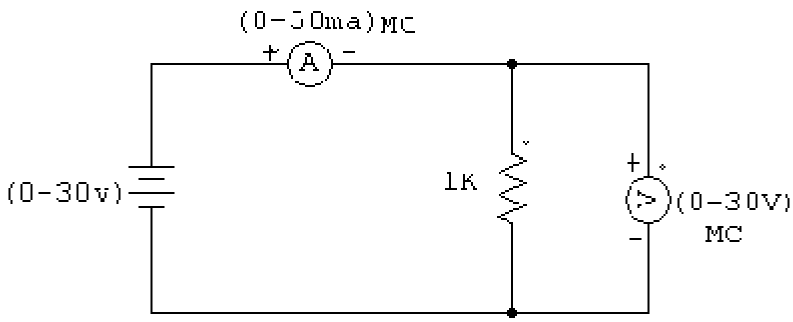
HOD/ EEE
Dr. L. Chitra

Experiment No – 1

VERIFICATION OF OHM'S LAW

Circuit Diagram :



Tabulation :

OHM'S Law			
S.No.	**Voltage**	**Current**	**Resistance**
1			
2			
3			
4			
5			

Formulae Used:

V=IR

Where V - Voltage

I - Current

R – Resistance

Experiment No : 1 Date :

VERIFICATION OF OHM'S LAW

Aim

To verify the ohm's law for the given electrical circuit

Apparatus Required

Sl. No	Name of the apparatus	Range	Type	Quantity
1	Regulated power supply	(0 - 30) V	Analog	1
2	Voltmeter	(0 - 30) V	MC	4
3	Resistor	1 kΩ, 1 W	-	3
4	Bread board	-	-	1
5	Connecting wires	-	-	As Required

Statement:

Ohm's law:

Ohm's law states that " At constant temperature, the steady current flowing through the conductor is directly proportional to the potential difference across the two ends of the conductor".

Manual Calculation :

Procedure:-

1. Connections are made as per the circuit diagram
2. By Varying the Input Voltage, the voltage and the corresponding current values are noted down for the given Resistor.
3. Repeat the same procedure for different values of Resistors

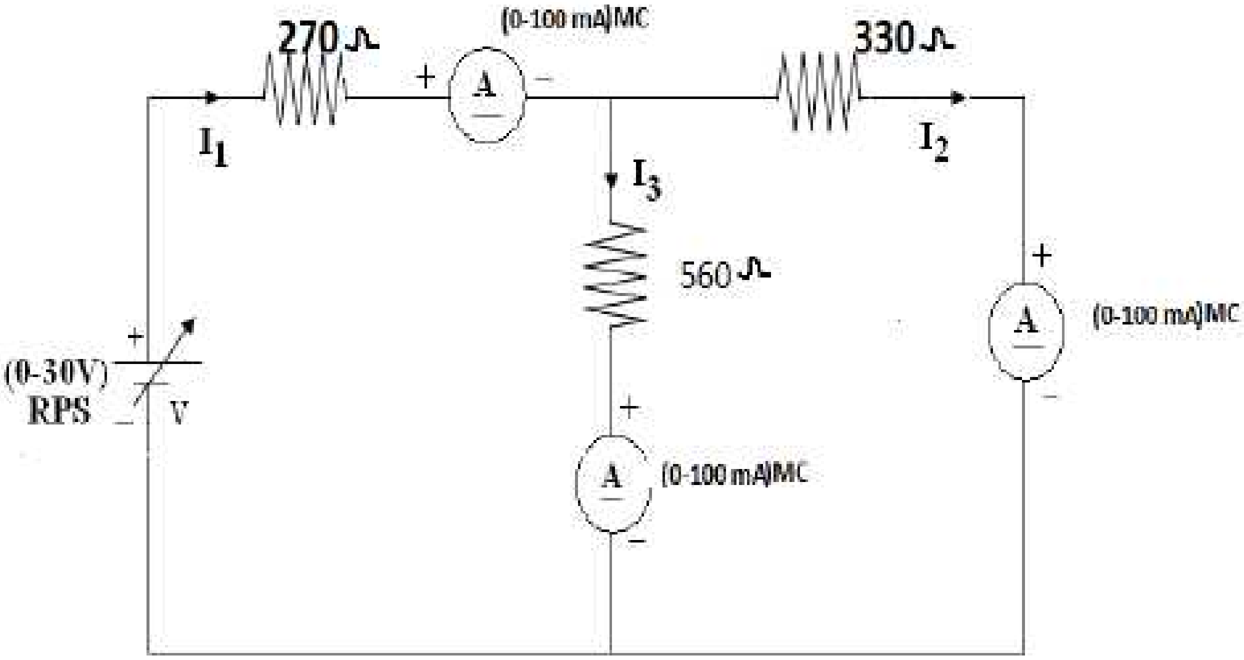
Result:

Thus Ohm’s law has been verified.

<u>Experiment No – 2</u>

VERIFICATION OF KIRCHHOFF’S LAWS

Circuit Diagram For Kirchhoff's Current Law:



Tabulation :

Applied Voltage (V)	I_1 (A)		I_2 (A)		I_3 (A)		$I_1 = I_2 + I_3$ (A)	
	Theoritical	Practical	Theoritical	Practical	Theoritical	Practical	Theoritical	Practical

Experiment No : 2 Date :

VERIFICATION OF KIRCHHOFF'S LAWS

Aim:

To verify

(i) Kirchhoff's current law

(ii) Kirchhoff's voltage law

Apparatus Required:

S. No.	Name of the Apparatus	Range	Type	Quantity
1	RPS			
2	Resistor			
3	Ammeter			
4	Voltmeter			
5	Bread Board			
6	Connecting Wires			

Statement :

Kirchhoff's Current Law (KCL) :

The law states, "The sum of the currents entering a node is equal to sum of the currents leaving the same node". Alternatively, the algebraic sum of current at a node is equal to zero.

The term node means a common point where the different elements are connected. Assume negative sign for leaving current and positive sign for entering current.

Formulae:

$$\sum \text{Currents Entering a Node} = \sum \text{Currents Leaving a Node}$$

$$I_1 = I_2 + I_3$$

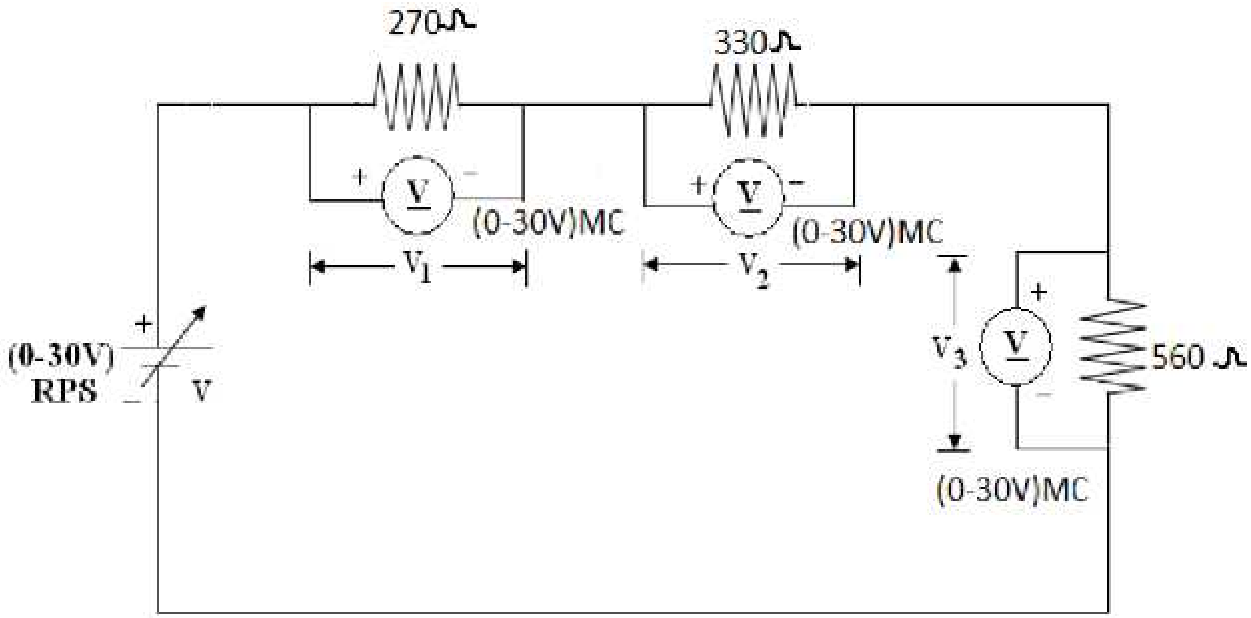
Manual Calculation :

Procedure :

To Verify KCL :

1. Connect the circuit as per the circuit diagram.
2. Switch on the supply.
3. Set different values of voltages in the RPS.
4. Measure the corresponding values of branch currents I_1, I_2 and I_3.
5. Enter the readings in the tabular column.
6. Sum up the Ammeter readings (I_2 and I_3) , that should be equal to total current (I_1).
7. Find the theoretical values and compare with the practical values.

Circuit Diagram For Kirchhoff's Voltage Law:



Tabulation :

Applied Voltage (V)	V_1 (V)		V_2 (V)		V_3 (V)		$V_1 = V_1+V_2 + I_3$ (V)	
	Theoretical	Practical	Theoretical	Practical	Theoretical	Practical	Theoretical	Practical

Kirchhoff's Voltage Law (KVL)

The law states, "The algebraic sum of the voltages in a closed circuit / mesh is zero".

The voltage rise is taken as positive and the voltage drop is taken as negative.

Formulae:

$$\sum \text{Voltages in a Closed Loop} = 0$$

$$V - V_1 - V_2 - V_3 = 0$$

Procedure:

1. Connect the circuit as per the circuit diagram.
2. Switch on the supply.
3. Set different values of voltages in the RPS.
4. Measure the corresponding values of voltages (V_1, V_2 and V_3) across resistors R_1, R_2 and R_3 respectively.
5. Enter the readings in the tabular column.
6. Find the theoretical values and compare with the practical values.

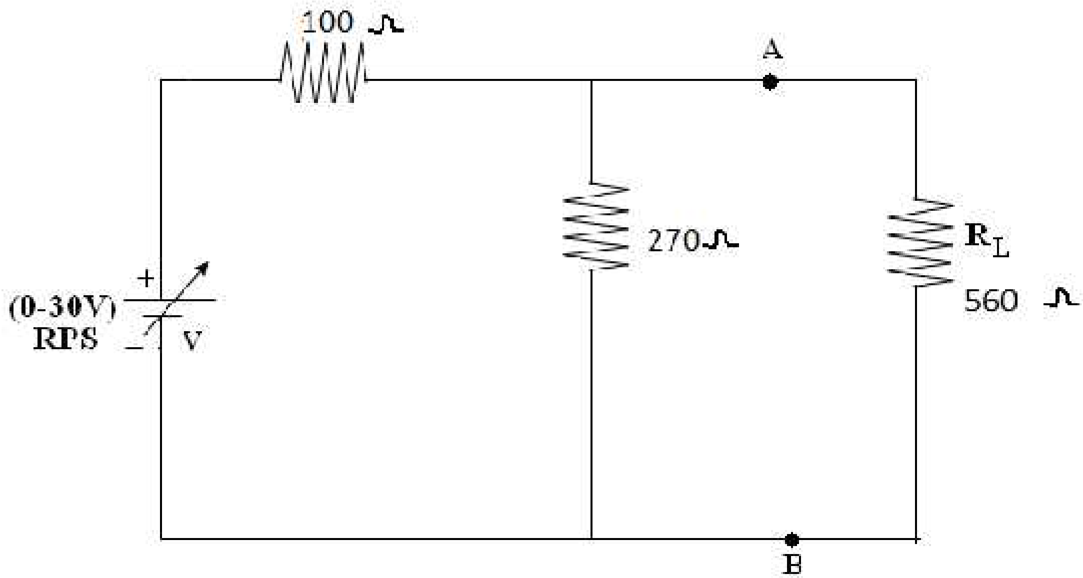
RESULT:

Thus the Kirchhoff's Current and Voltage laws are verified.

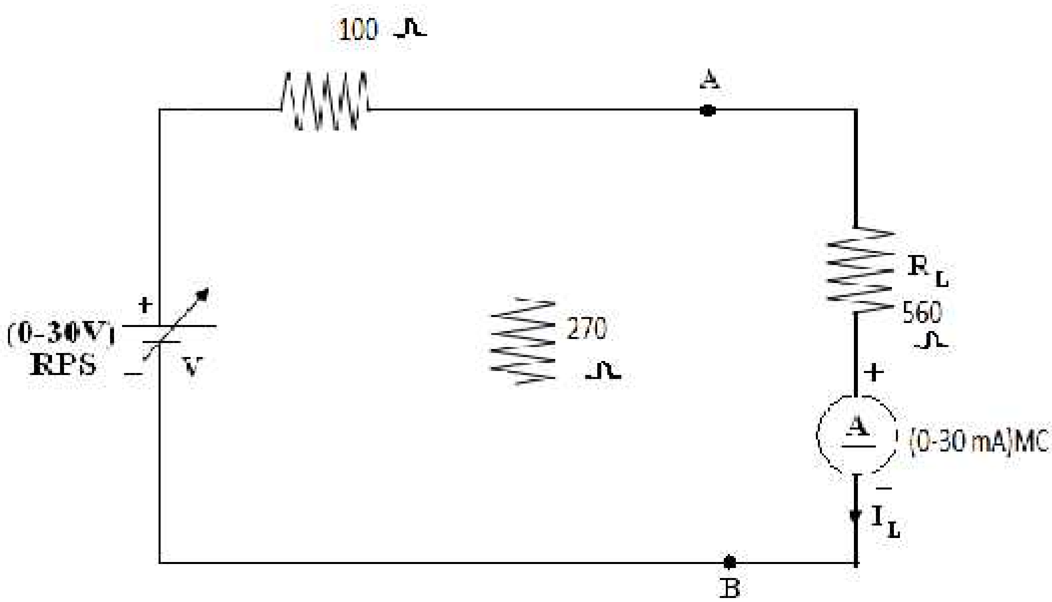
Experiment No – 3

VERIFICATION OF THEVENIN'S THEOREM

Circuit Diagram For Thevenin's Theorem:



To Find Load Current:



Experiment No : 3 Date :

VERIFICATION OF THEVENIN'S THEOREM

AIM:

To verify Thevenin's Theorem

APPARATUS REQUIRED:

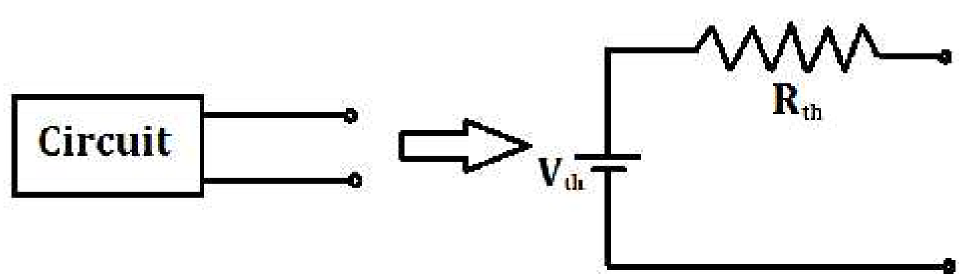
S. No.	Name of the Apparatus	Range	Type	Quantity
1	RPS			
2	DC Power Supply			
3	Resistor			
4	Ammeter			
5	Voltmeter			
6	Bread Board			
7	Connecting Wires			

Statement :

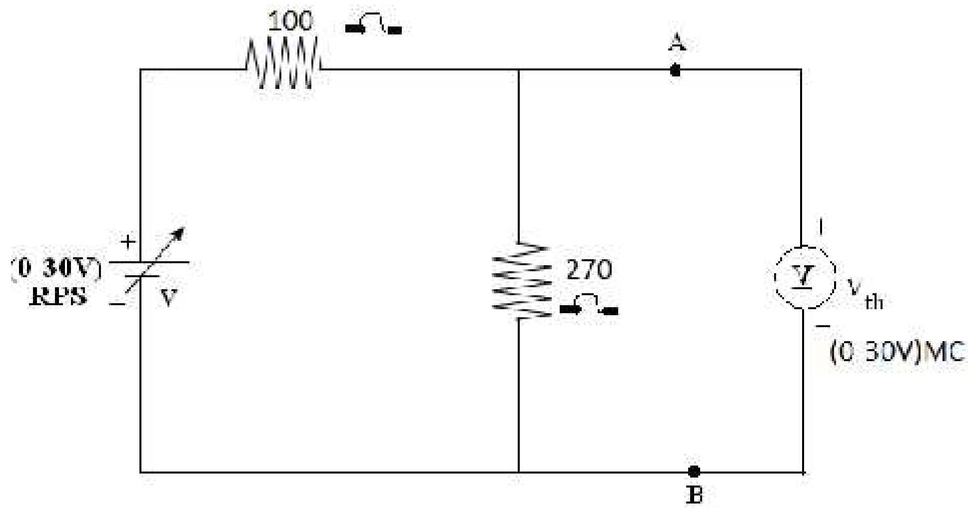
Thevenin's Theorem:

Any two-terminal linear network, composed of voltage sources, current sources, and resistors, can be replaced by an equivalent two-terminal network consisting of an independent voltage source in series with a resistor.

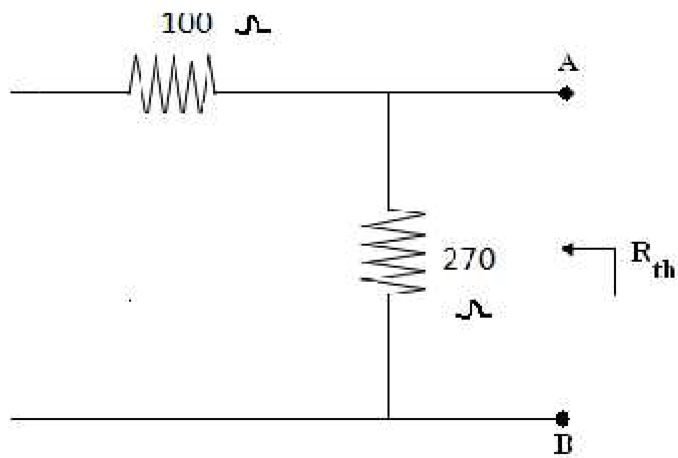
The value of voltage source is equivalent to the open circuit voltage (Vth) across two terminals of the network and the resistance is equal to the equivalent resistance (Rth) measured between the terminals with all energy sources replaced by their internal resistances.



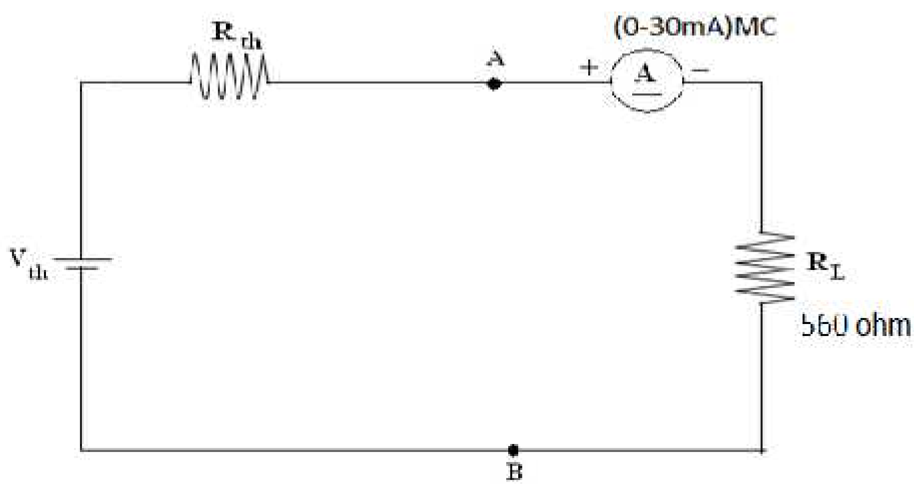
To Find V_{th}:



To Find R_{th}:



Thevenin's Equivalent Circuit :



PROCEDURE:

1. Give connections as per the circuit diagram
2. Measure the current through RL in the ammeter
3. Open circuit the output terminals by disconnecting load resistance R_L.
4. Connect a voltmeter across AB and measure the open circuit voltage V_{th}.
5. To find R_{th}, replace the voltage source by short circuit.
6. Give connections as per the Thevenin's Equivalent circuit.
7. Measure the current through load resistance in Thevenin's Equivalent circuit
8. Verify Thevenin's theorem by comparing the measured currents in Thevenin's Equivalent circuit with the values calculated theoretically

Tabulation :

S. No.	V_{DC} (Volts)	V_{th} (Volts)		R_{th} (Ohms)		Current through Load Resistance	
		Practical Value	Theoretical Value	Practical Value	Theoretical Value	Practical Value	Theoretical Value

Manual Calculation :

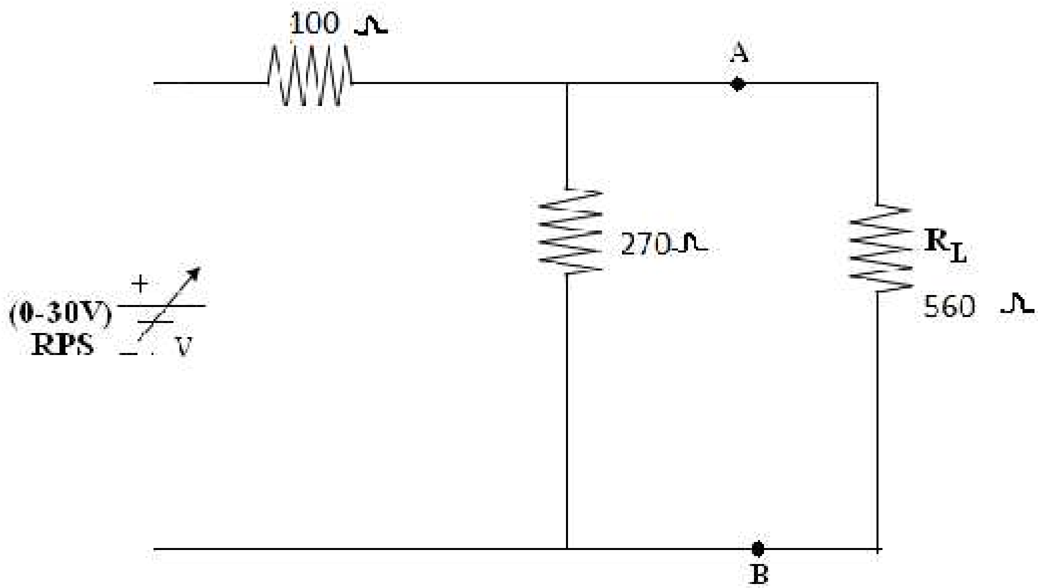
RESULT:

Thus the Thevenin's theorem was verified.

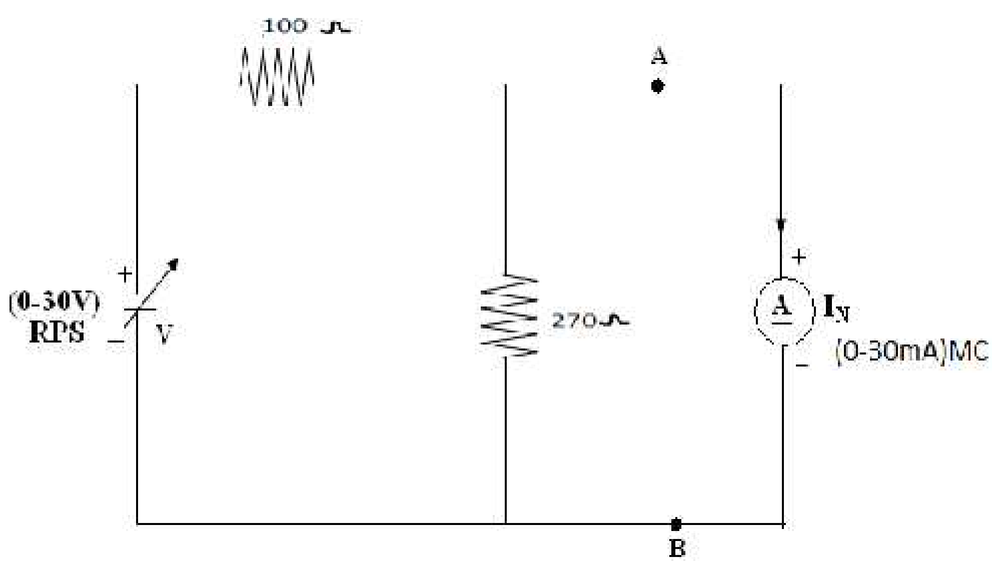
Experiment No – 4

VERIFICATION OF NORTON’S THEOREM

Circuit Diagram For Norton's Theorem:



To Find Norton's Current:



Experiment No : 4 Date :

VERIFICATION OF NORTON'S THEOREM

Aim:

To verify Norton's Theorem

Apparatus Required:

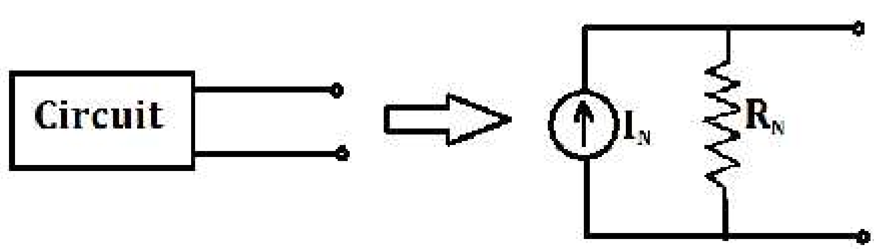
S. No.	Name of the Apparatus	Range	Type	Quantity
1	RPS			
2	DC Power Supply			
3	Resistor			
4	Ammeter			
5	Voltmeter			
6	Bread Board			
7	Connecting Wires			

Statement:

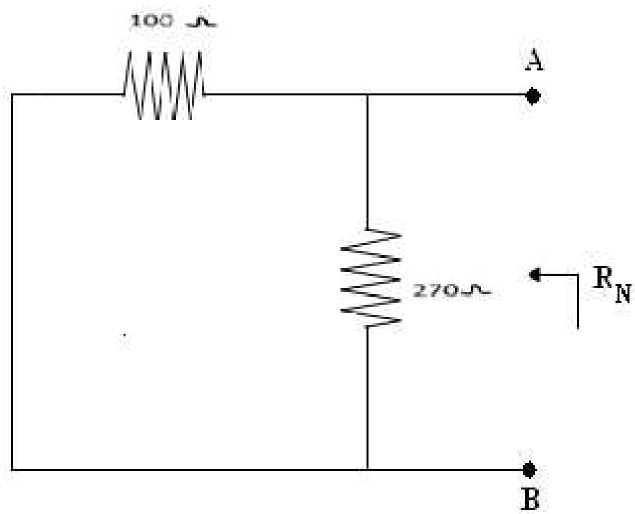
Norton's Theorem:

Any two-terminal linear network, composed of voltage sources, current sources, and resistors, can be replaced by an equivalent two-terminal network consisting of an independent current source in parallel with a resistor.

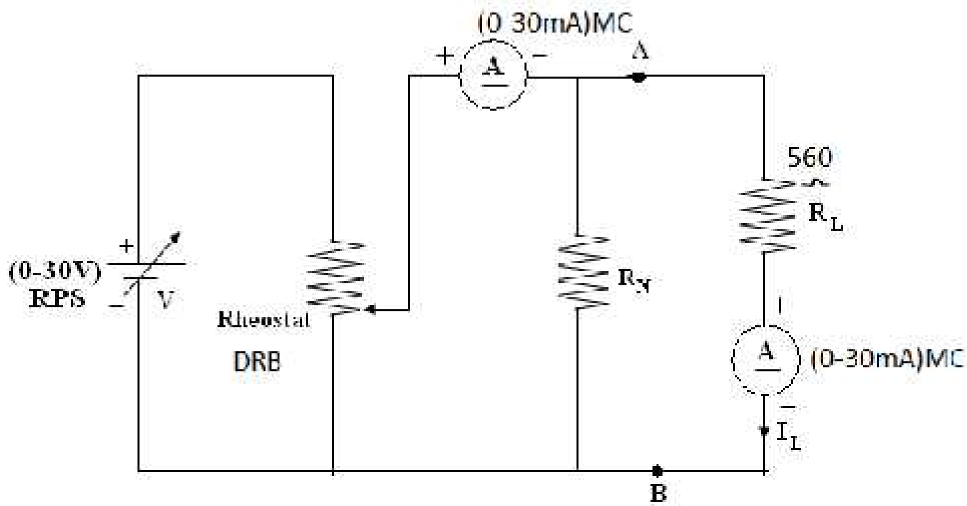
The value of the current source is the short circuit current (I_N) between the two terminals of the network and the resistance is equal to the equivalent resistance (R_N) measured between the terminals with all energy sources replaced by their internal resistances.



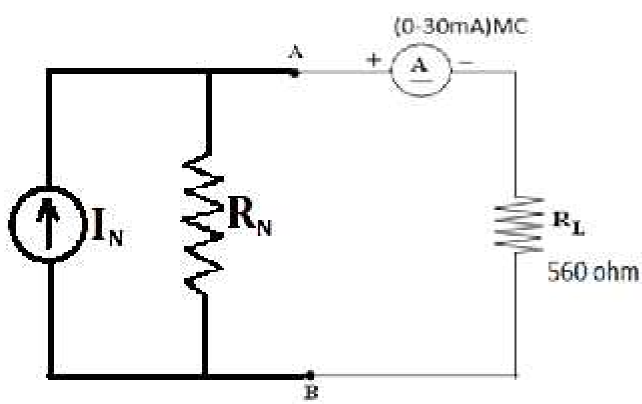
To Find Norton's Resistance:



Norton's Equivalent Circuit:



Norton's Equivalent Circuit:



PROCEDURE:

1. Give connections as per the circuit diagram.
2. Measure the current through R_L in ammeter.
3. Short circuit A and B through an ammeter.
4. Measure the Norton current in the ammeter.
5. Find out the Norton's Resistance viewed from the output terminals.
6. Give connections as per the Norton's Equivalent circuit.
7. Measure the current through R_L.
8. Verify Norton's theorem by comparing currents in R_L directly and that obtained with the equivalent circuit.

Tabulation :

S. No.	V_{DC} (Volts)	I_N (mA)		R_N (Ohms)		Current through Load Resistance I_L in mA	
		Practical Value	Theoretical Value	Practical Value	Theoretical Value	Practical Value	Theoretical Value

Manual Calculation :

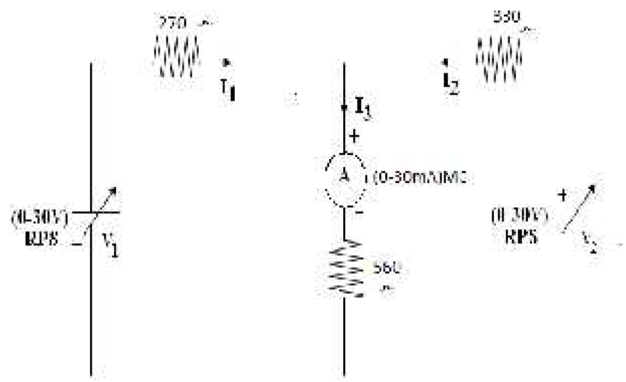
Result:

Thus the Norton’s theorem was verified.

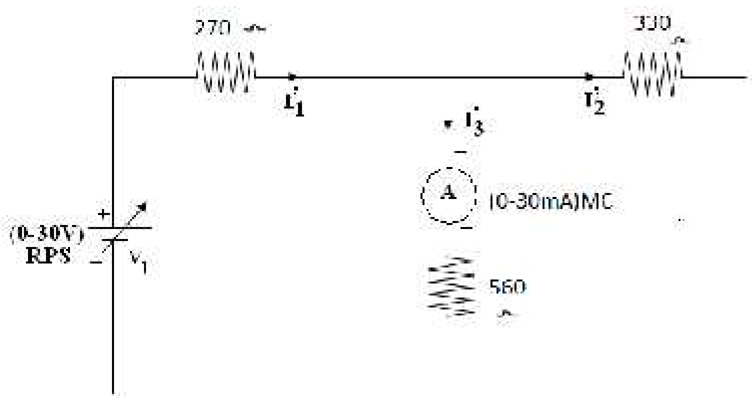
Experiment No – 5

VERIFICATION OF SUPERPOSITION THEOREM

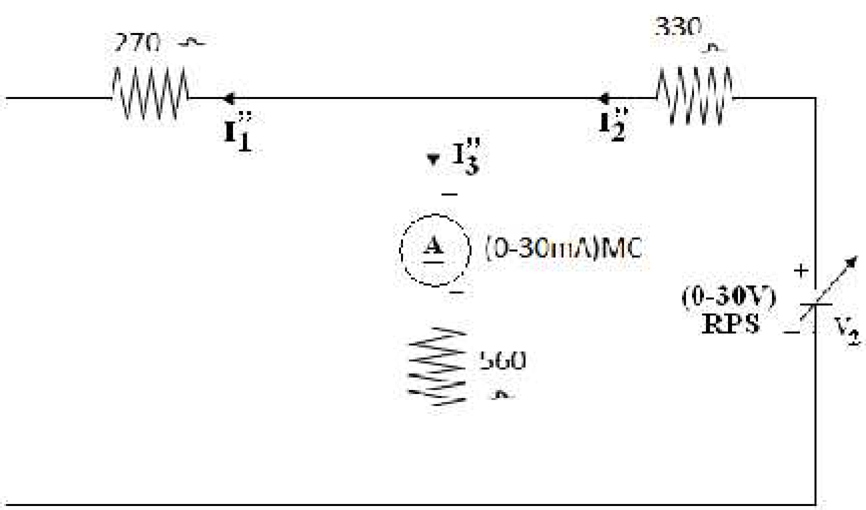
Circuit Diagram For Superposition Theorem:



Circuit Diagram with V_1 Acting Independently:



Circuit Diagram with V_2 Acting Independently:



Experiment No : 5 Date :

VERIFICATION OF SUPERPOSITION THEOREM

Aim:

To verify Superposition Theorem

Apparatus Required:

S. No.	Name of the Apparatus	Range	Type	Quantity
1	RPS			
2	Resistor			
3	Ammeter			
4	Voltmeter			
5	Bread Board			
6	Connecting Wires			

Statement:

Superposition Theorem:

In any linear, bilateral network energized by two or more sources, the total response is equal to the algebraic sum of the responses caused by individual sources acting alone while the other sources are replaced by their internal resistances.

To replace the other sources by their internal resistances, the voltage sources are short-circuited and the current sources open- circuited.

Formulae:

$$I_3 = I_3' + I_3''$$

Tabulation :

S. No.	Experimental Values			Theoretical Values		
	V_1 (Volts)	V_2 (Volts)	I_3 (mA)	V_1 (Volts)	V_2 (Volts)	I_3 (mA)

Verification of Superposition Theorem:

S. No.	Practical Values				Theoretical Values			
	I_3 (mA)	I'_3 (mA)	I''_3 (mA)	$I_3 = I'_3 + I''_3$ (mA)	I_3 (mA)	I'_3 (mA)	I''_3 (mA)	$I_3 = I'_3 + I''_3$ (mA)

Procedure :

1. Connections are made as per the circuit diagram given in Figure 1.
2. Switch on the supply.
3. Note the readings of three Ammeters.
4. One of the voltage source V_1 is connected and the other voltage source V_2 is short circuited as given in Figure 2.
5. Note the three ammeter readings.
6. Now short circuit the voltage source V_1 and connect the voltage source V_2 as given in the circuit diagram of Figure 3.
7. Note the three ammeter readings.
8. Algebraically add the currents in steps (5) and (7) above to compare with the current in step (3) to verify the theorem.
9. Verify with theoretical values.

Manual Calculation:

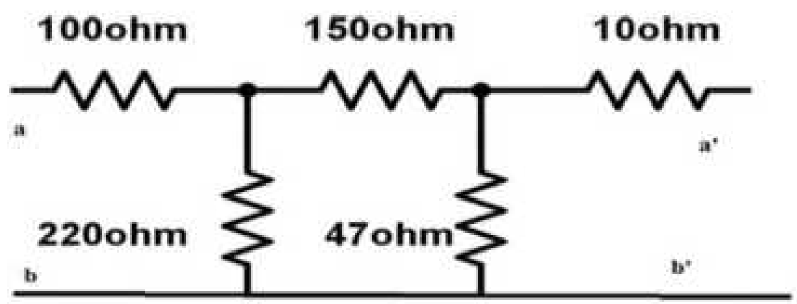
Result :

Thus the Superposition theorem was verified.

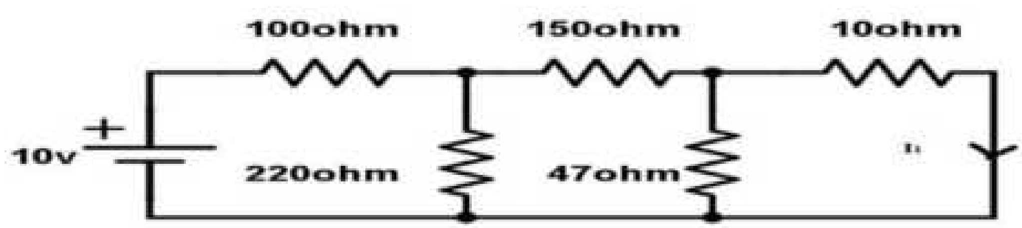
<u>Experiment No – 6</u>

VERIFICATION OF RECIPROCITY THEOREM

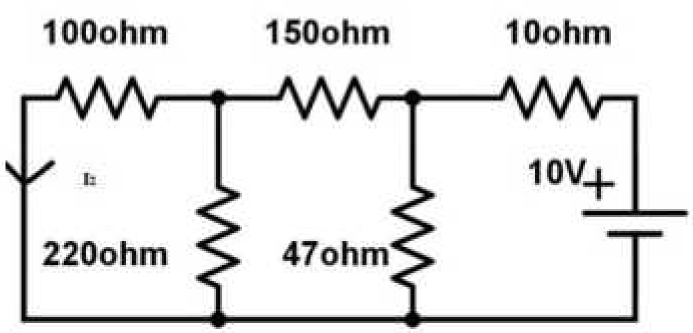
Circuit Diagram :



Response due to 10 V before interchanging load :



Response due to 10 V after interchanging load :



Experiment No : 6 Date :

VERIFICATION OF RECIPROCITY THEOREM

Aim:

To verify the condition of Reciprocity for an electric network.

Apparatus Required:

S. No.	Name of the Apparatus	Range	Type	Quantity
1	RPS			
2	Resistor			
3	Ammeter			
4	Voltmeter			
5	Bread Board			
6	Connecting Wires			

Statement:

Reciprocity Theorem:

In any linear, bilateral, single source network the ratio of excitation to response is constant even when their positions are interchanged.

Tabulation:

Parameters	Theoretical Values	Practical Values

Manual Calculation:

Procedure :

1. Connect the circuit as shown in fig.
2. Measure the current I_1 in the branch.
3. Interchange voltage source and response as shown in fig 3 and note down the current I_2.
4. Observe that the currents I_1 and I_2 should be same.
5. Measure the ratio of excitation and response and check whether they are equal in both cases are not.

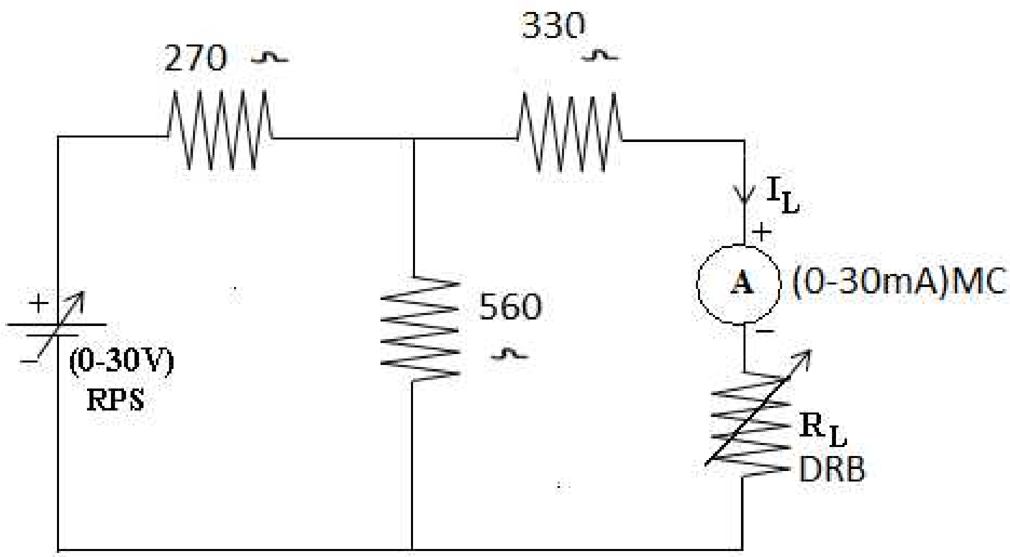
Result :

Thus the Reciprocity theorem was verified.

Experiment No – 7

VERIFICATION OF MAXIMUM POWER TRANSFER THEOREM

Circuit Diagram:



Tabulation :

S. No.	RL (kΩ)	IL (mA)			P = I^2 RL (mW)	
		Practical Values	Theoretical Values		Practical Values	Theoretical Values

Experiment No : 7 Date :

VERIFICATION OF MAXIMUM POWER TRANSFER THEOREM

Aim:

To verify Maximum Power Transfer Theorem

Apparatus Required:

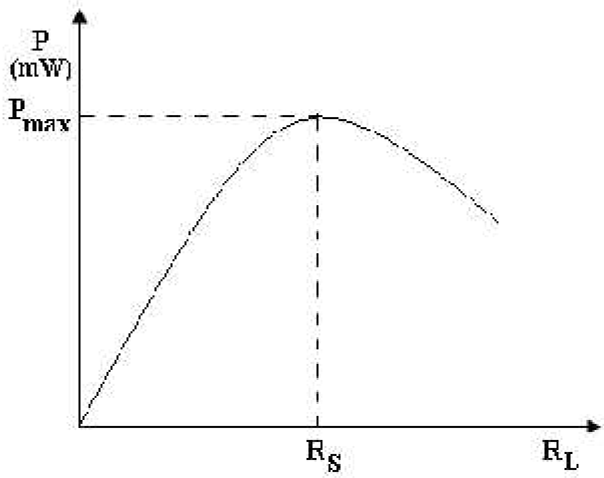
S. No.	Name of the Apparatus	Range	Type	Quantity
1	RPS			
2	Resistor			
3	Ammeter			
4	Voltmeter			
5	Bread Board			
6	Connecting Wires			

Statement:

Maximum Power Transfer Theorem:

The Maximum Power Transfer Theorem states that maximum power is delivered from a source to a load when the load resistance is equal to source resistance.

Model Graph :



Manual Calculation:

Procedure :

1. Find the Load current for the minimum position of the Rheostat theoretically.
2. Select the ammeter Range.
3. Give connections as per the circuit diagram.
4. Measure the load current by gradually increasing R_L.
5. Enter the readings in the tabular column.
6. Calculate the power delivered in R_L.
7. Plot the curve between R_L and power.
8. Check whether the power is maximum at a value of load resistance that equals source resistance.
9. Verify the maximum power transfer theorem.

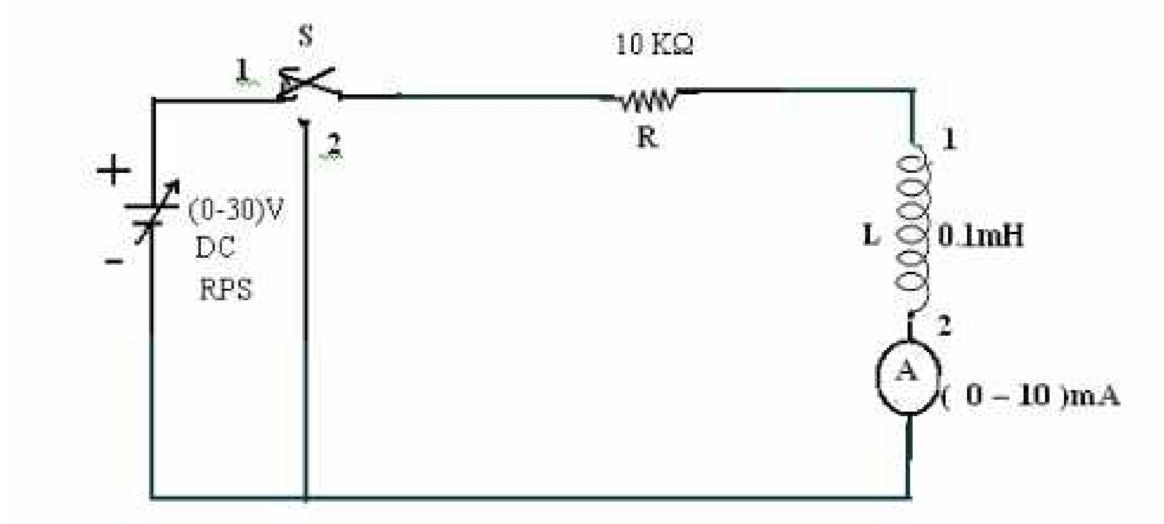
Result :

Thus the Maximum power transfer theorem was verified.

<u>Experiment No – 8</u>

TIME DOMAIN ANALYSIS OF RL TRANSIENT CIRCUITS

Circuit Diagram for RL Transients:



Tabulation :

Sl No	Time (Seconds)	Charging Current (Amps)	Discharging Current (Amps)

Experiment No : 8 Date :

TIME DOMAIN ANALYSIS OF RL TRANSIENT CIRCUITS

Aim:

To find the time constant of series RL electric circuits.

Apparatus Required:

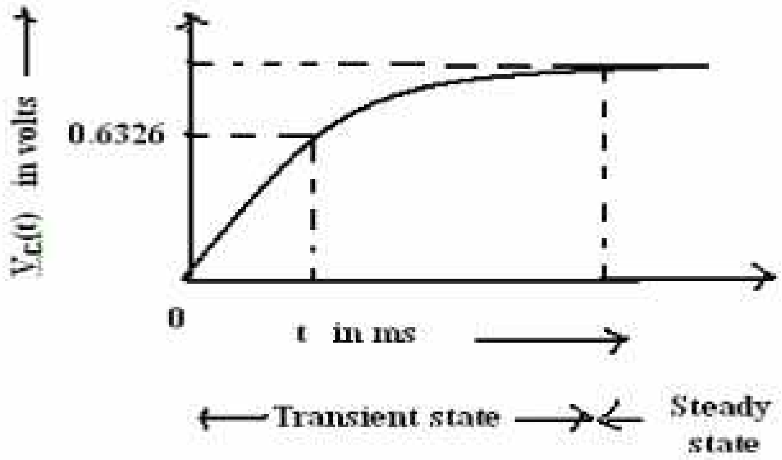
S. No.	Name of the Apparatus	Range	Type	Quantity
1	Resistor			
2	Function Generator			
3	Voltmeter			
4	Decade Inductance Box			
5	Bread Board			
6	Connecting Wires			

RL Transient Circuit :

Electrical devices are controlled by switches which are closed to connect supply to the device, or opened in order to disconnect the supply to the device. The switching operation will change the current and voltage in the device. The purely resistive devices will allow instantaneous change in current and voltage.

An inductive device will not allow sudden change in current and capacitance device will not allow sudden change in voltage. Hence when switching operation is performed in inductive and capacitive devices, the current & voltage in device will take a certain time to change from pre switching value to steady state value after switching. This phenomenon is known as transient. The study of switching condition in the circuit is called transient analysis. The state of the circuit from instant of switching to attainment of steady state is called transient state. The time duration from the instant of switching till the steady state is called transient period. The current & voltage of circuit elements during transient period is called transient response.

Model Graph :



Charging current and voltage in inductor are given as below,

$$i = \frac{E}{R}\left(1 - e^{-\frac{Rt}{L}}\right) = I\left(1 - e^{-\frac{t}{T}}\right)$$

Here, $I = \frac{E}{R}$ is the steady current.

$T = \frac{L}{R}$ is called time constant of the RL circuit.

$$V_L = Ee^{\frac{-t}{T}}$$

Model Calculation:

Procedure :

1. Connections are made as per the circuit diagram.
2. Before switching ON the power supply the switch S should be in off position
3. Now switch ON the power supply and change the switch to ON position.
4. The voltage is gradually increased and note down the reading of ammeter and voltmeter for each time duration in RL circuit measure the Ammeter reading.
5. Tabulate the readings and draw the graph

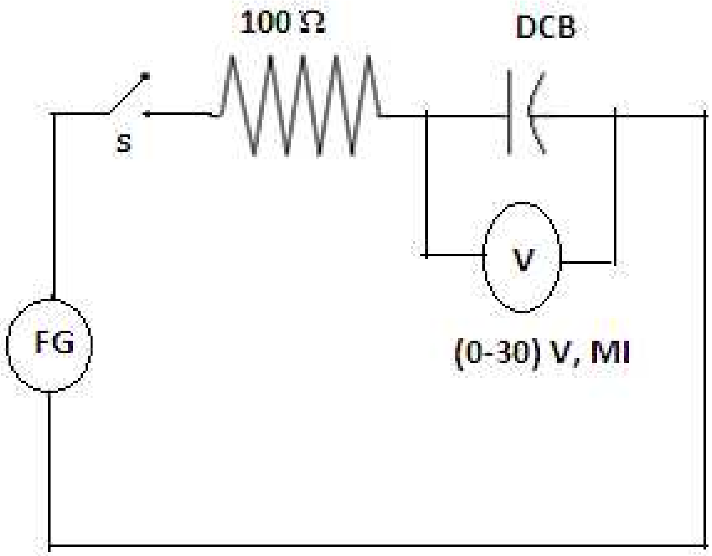
Result :

Thus the transient response of RL circuit for DC input was verified.

Experiment No – 9

TIME DOMAIN ANALYSIS OF RC TRANSIENT CIRCUITS

Circuit Diagram For RC Transient:



Tabulation :

S. No.	Frequency (Hz)	Time (sec)	Voltage across the capacitor V_C (Volts)

Experiment No : 9 Date :

TIME DOMAIN ANALYSIS OF RC TRANSIENT CIRCUITS

Aim:

To find the time constant of series R-C electric circuits.

Apparatus Required:

S. No.	Name of the Apparatus	Range	Type	Quantity
1	Resistor			
2	Function Generator			
3	Voltmeter			
4	Decade Capacitance Box			
5	Bread Board			
6	Connecting Wires			

RC Transient Circuit:

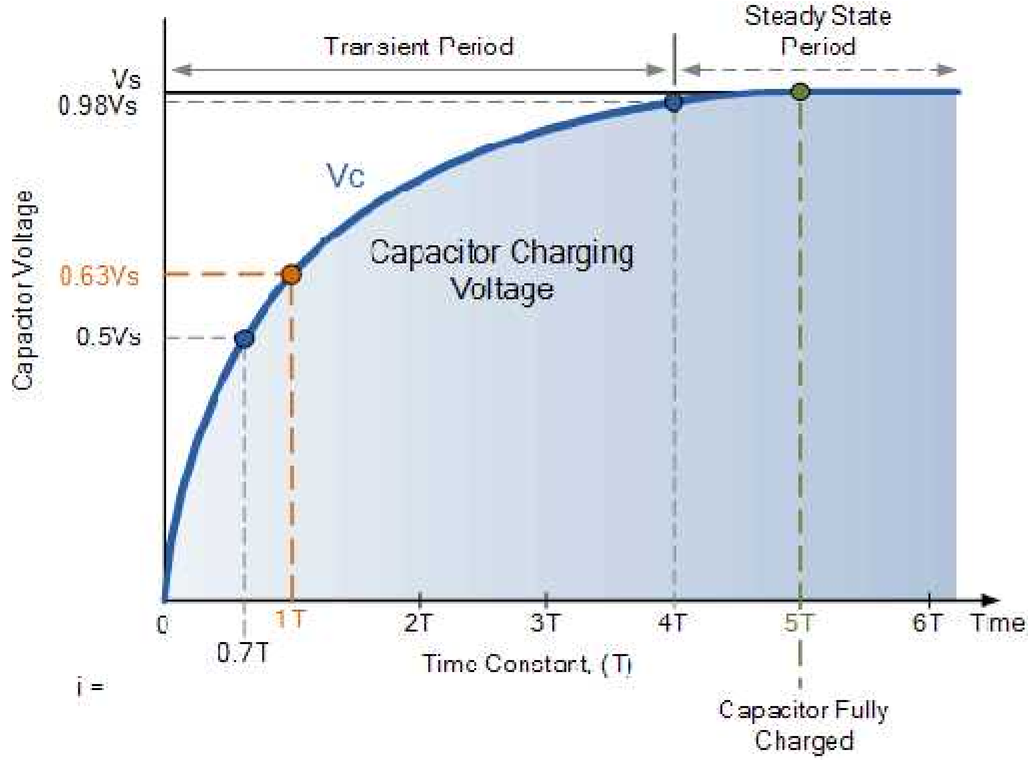
Consider a series RC circuit as shown. The switch is in open state initially. There is no charge on condenser and no voltage across it. At instant t=0, switch is closed.

Immediately after closing a switch, the capacitor acts as a short circuit, so current at the time of switching is high. The voltage across capacitor is zero at t = 0+ as capacitor acts as a short circuit, and the current is maximum given by,

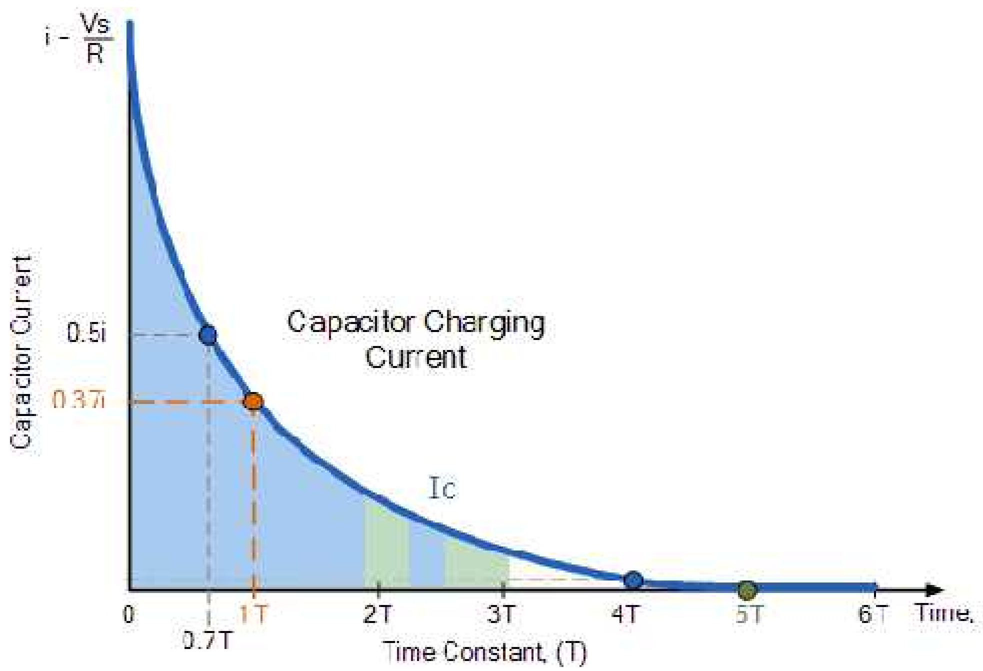
$$i = \frac{V}{R}\ Amps$$

This current is maximum at $t = 0^+$ which is charging current. As the capacitor starts charging, the voltage across capacitor VC starts increasing and charging current starts decreasing. After some time, when the capacitor charges to V volts, it achieves steady state. In steady state it acts as an open circuit and current will be zero finally.

Model Graph :



Steady State
Period
Transient Period
Vs
0.98Vs
Vc
Capacitor Charging
Voltage
0.63Vs
0.5Vs
Capacitor Voltage
0
0.7T
1T
2T
3T
4T
5T
6T
Time,
Time Constant, (T)
i =
Capacitor Fully
Charged



i = Vs/R
Capacitor Charging
Current
0.5i
0.37i
Ic
Capacitor Current
0
0.7T
1T
2T
3T
4T
5T
6T
Time, t
Time Constant, (T)

Charging current and voltage in capacitor are given as below,

$$I_C = \frac{V_{in}}{R} e^{\frac{-t}{RC}} = \frac{V_{in}}{R} e^{\frac{-t}{\tau}}$$

$$V_C = V_{in}\left(1 - e^{\frac{-t}{RC}}\right) == V_{in}\left(1 - e^{\frac{-t}{\tau}}\right)$$

The term RC in equation of V_C or I_C is called Time constant and denoted by τ, measured in seconds. When,

$$t = RC = \tau$$

Then,

$$V_C = 0.632 V_{in}$$

So time constant of series RC circuit is defined as time required by the capacitor voltage to rise from zero to 0.632 of its final steady state value during charging.

Thus, time constant of RC circuit can be defined as time seconds, during which voltage across capacitor (stating from zero) would reach its final steady state value if its rate of change was maintained constant at its initial value throughout charging period.

Model Calculation:

Procedure :

1. Make the connections as per the circuit diagram.
2. Vary the frequency by using function generator.
3. For different frequencies tabulate the value of voltage across the capacitor.
4. Calculate the time period.
5. Plot the graph for time period Vs voltage across the capacitor.

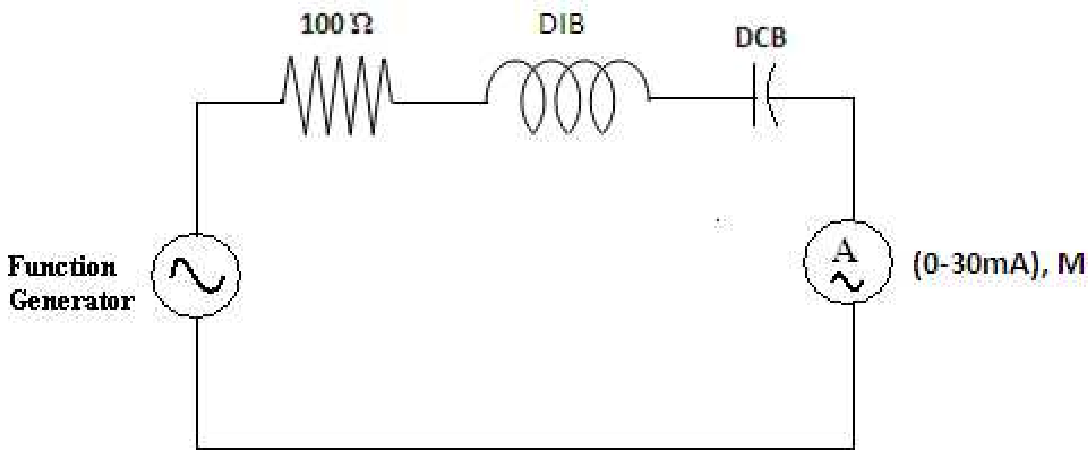
Result :

Thus the transient responses of RC circuit are found practically.

Experiment No – 10

SERIES RESONANCE CIRCUIT

Circuit Diagram :



Tabulation :

S. No.	Frequency (Hz)	Output Current in mA

Experiment No : 10 Date :

SERIES RESONANCE CIRCUIT

Aim :

To plot the current Vs frequencies graph of series resonant circuits and hence measure their bandwidth, resonant frequency and Q factor.

Apparatus Required:

S. No.	Name of the Apparatus	Range	Type	Quantity
1	Resistor			
2	Function Generator			
3	Ammeter			
4	Decade Capacitance Box			
5	Decade Inductance Box			
6	Bread Board			
7	Connecting Wires			

Series Resonance Circuit:

A circuit is said to be in resonance when applied voltage V and current I are in phase with each other. Thus at resonance condition, the equivalent complex impedance of the circuit consists of only resistance (R) and hence current is maximum. Since V and I are in phase, the power factor is unity.

The complex impedance,

$$Z = R + j(X_L - X_C)$$

Where,

$$X_L = \omega L \text{ and } X_C = \frac{1}{\omega C}$$

At Resonance $X_L = X_C$ and Z = R

Model Calculation :

Bandwidth of a Resonance Circuit:

Bandwidth of a circuit is given by the band of frequencies which lies between two points on either side of resonance frequency, where current falls through 1/1.414 of the maximum value of resonance. Narrow is the bandwidth, higher the selectivity of the circuit.

As shown in the model graph, the bandwidth AB is given by $f_2 - f_1$. f_1 is the lower cut off frequency and f_2 is the upper cut off frequency.

Q-Factor:

In the case of a RLC series circuit, Q-factor is defined as the voltage magnification in the circuit at resonance. At resonance, current is maximum. $I_O = V/R$.

The applied voltage, $V = I_O R$

Voltage magnification = $V_L/V = I_O X_L$

In the case of resonance, high Q factor means not only high voltage, but also higher sensitivity of tuning circuit. Q factor can be increased by having a coil of large inductance, not of smaller ohmic resistance.

$$Q = \omega L / R$$

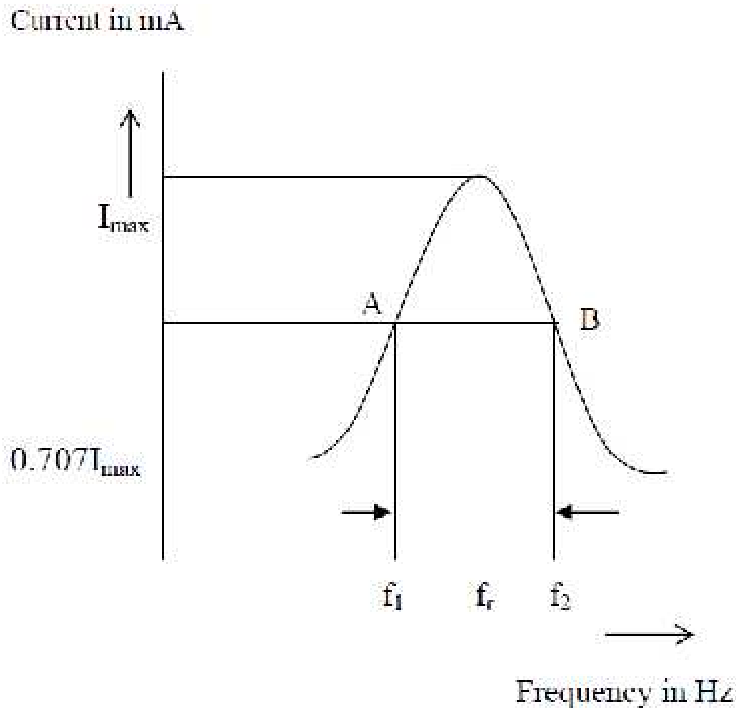
Formulae :

Resonant Frequency, $f_r = \frac{1}{2\pi\sqrt{LC}}\ Hz$

Bandwidth, $BW = f_2 - f_1\ Hz$

Quality Factor $Q = \frac{f_r}{BW} = \frac{\omega L}{R}$

Model Graph :



Procedure :

1. Connect the circuit as shown in fig. for series resonant circuit
2. Set the voltage of the signal from function generator to 10V.
3. Vary the frequency of the signal in steps and note down the magnitude of response on CRO respectively.(response wave form is observed across element R)
4. Form the observation table between the frequency and magnitude of response in CRO for series resonance circuit.
5. Draw a graph between frequency and magnitude of response and determine the resonant frequency, quality factor and bandwidth of series RLC circuit.

Result :

Thus the current Vs frequency graphs of series resonant circuits were plotted and the bandwidth, resonant frequency and Q factor were measured.

They were found to be Series resonance

Resonant frequency =

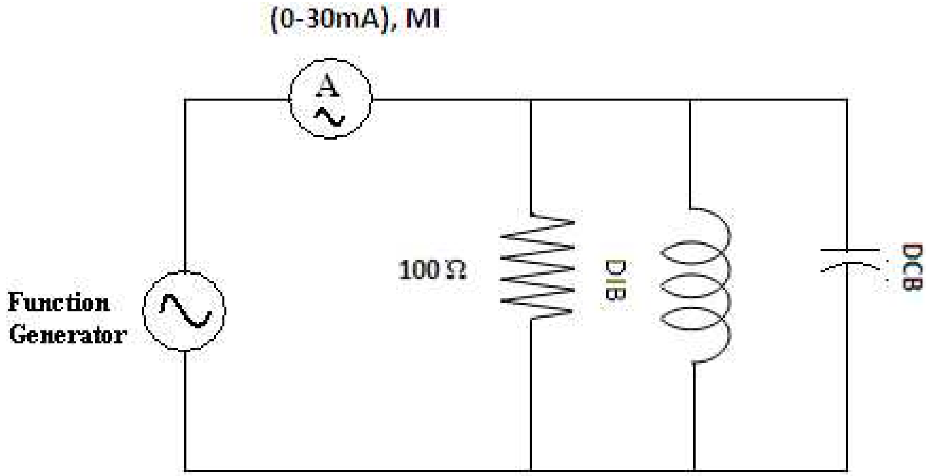
Bandwidth =

Q- Factor =

Experiment No – 11

PARALLEL RESONANCE CIRCUIT

Circuit Diagram :



Tabulation :

S. No.	Frequency (Hz)	Output Current in mA

Experiment No : 11 Date :

PARALLEL RESONANCE CIRCUIT

Aim:

To plot the current Vs frequencies graph of parallel resonant circuits and hence measure their bandwidth, resonant frequency and Q factor.

Apparatus Required:

S. No.	Name of the Apparatus	Range	Type	Quantity
1	Resistor			
2	Function Generator			
3	Ammeter			
4	Decade Capacitance Box			
5	Decade Inductance Box			
6	Bread Board			
7	Connecting Wires			

Parallel Resonance Circuit:

A circuit is said to be in resonance when applied voltage V and current I are in phase with each other. Thus at resonance condition, the equivalent complex impedance of the circuit consists of only resistance (R) and hence current is maximum. Since V and I are in phase, the power factor is unity.

The complex impedance,

$$Z = R + j(X_L - X_C)$$

Where,

$X_L = \omega L$ and $X_C = \frac{1}{\omega C}$

At Resonance $X_L = X_C$ and Z = R

Model Calculation :

Bandwidth of a Resonance Circuit:

Bandwidth of a circuit is given by the band of frequencies which lies between two points on either side of resonance frequency, where current falls through 1/1.414 of the maximum value of resonance. Narrow is the bandwidth, higher the selectivity of the circuit.

As shown in the model graph, the bandwidth AB is given by $f_2 - f_1$. f_1 is the lower cut off frequency and f_2 is the upper cut off frequency.

Q-Factor:

In the case of a RLC series circuit, Q-factor is defined as the voltage magnification in the circuit at resonance. At resonance, current is maximum. $I_O = V/R$.

The applied voltage, $V = I_O R$

Voltage magnification = $V_L/V = I_O X_L$

In the case of resonance, high Q factor means not only high voltage, but also higher sensitivity of tuning circuit. Q factor can be increased by having a coil of large inductance, not of smaller ohmic resistance.

$$Q = \omega L / R$$

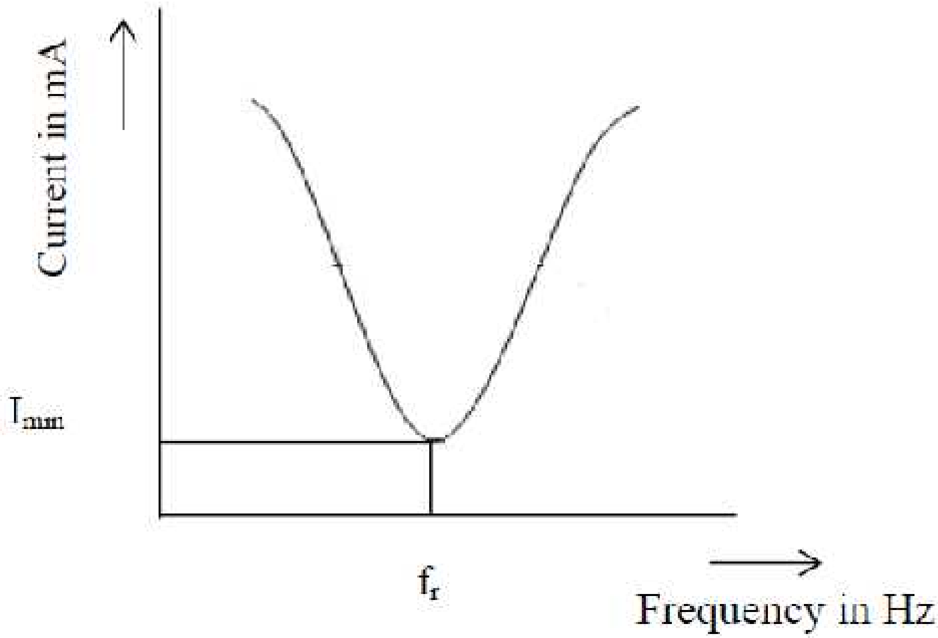
Formulae :

Resonant Frequency, $f_r = \frac{1}{2\pi\sqrt{LC}}\ Hz$

Bandwidth, $BW = f_2 - f_1\ Hz$

Quality Factor $Q = \frac{f_r}{BW} = \frac{\omega L}{R}$

Model Graph :



Procedure :

1. Connect the circuit as shown in fig. for Parallel resonant circuit
2. Set the voltage of the signal from function generator to 10V.
3. Vary the frequency of the signal in steps and note down the magnitude of response on CRO respectively.(response wave form is observed across element R)
4. Form the observation table between the frequency and magnitude of response in CRO for Parallel resonance circuit.
5. Draw a graph between frequency and magnitude of response and determine the resonant frequency, quality factor and bandwidth of Parallel RLC circuit.

Result :

Thus the current Vs frequency graphs of parallel resonant circuits were plotted and the bandwidth, resonant frequency and Q factor were measured.

They were found to be Series resonance

Resonant frequency =

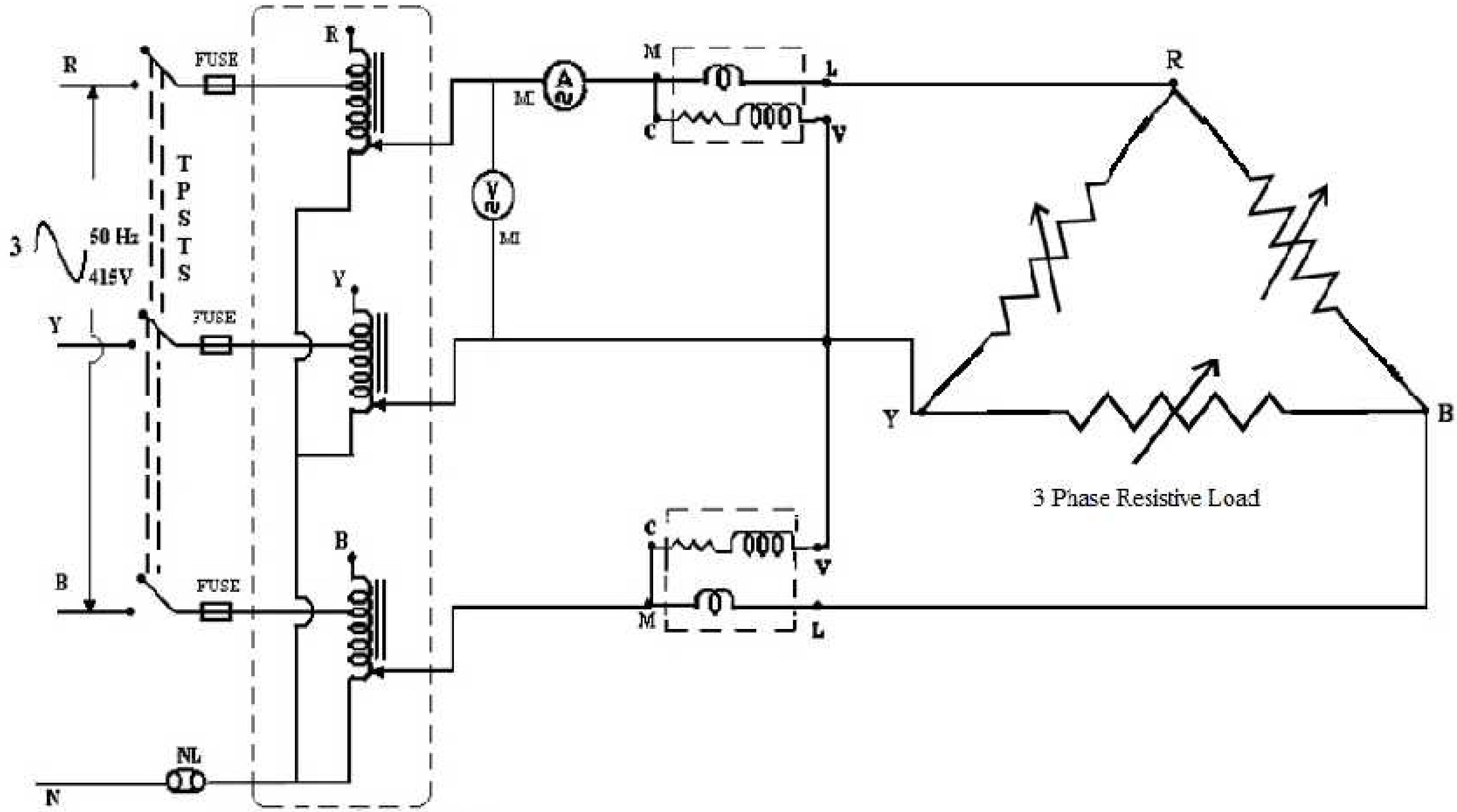
Bandwidth =

Q- Factor =

Experiment No – 12

THREE PHASE POWER MEASUREMENT BY TWO WATTMETER METHOD

Circuit Diagram :



(415 V / (0 - 470 V)), 10 A,
3 Phase Variac

Experiment No : 12 Date :

THREE PHASE POWER MEASUREMENT BY TWO WATTMETER METHOD

Aim :

To conduct a suitable experiment on a 3-phase load connected in star or delta to measure the three phase power using 2 wattmeter method.

Apparatus Required :

S.NO	NAME OF THE APPRATUS	RANGE	TYPE	QUANTITY
1	Wattmeter			
2	Ammeter			
3.	Voltmeter			
5.	Connecting wires			

Theory :

Only two single phase wattmeters are sufficient to measure the total power consumed by a three phase balanced circuit. The two wattmeters are connected as shown in figure. The current coils are connected in series with two of the lines .The pressure (or voltage) coils of the two wattmeters are connected between that line and reference.

Formulae :

Output Power : $W = W_1 + W_2$ Watts

Power Factor : $Cos\emptyset = \sqrt{3}V_L I_L$

Tabulation :

Sl No	Load Voltage (V)	Load Current (A)	Wattmeter reading W_1 (Watts)	Wattmeter reading W_2 (Watts)	$W = W_1 + W_2$ (Watts)	Power $P = \sqrt{3}V_L I_L Cos\varphi$

Model Calculation:

Procedure :

1. Connections are given as per the circuit diagram
2. Close the TPST switch.
3. At the time of starting the three phase auto transformer is kept at the minimum position
4. Adjust the three phase auto transformer to get the rated voltage.
5. Vary the load step by step.
6. Note down the readings of ammeter, voltmeter and wattmeters and tabulated
7. Bring the three phase auto transformer is brought to original position.
8. Open the TPST switch.
9. Switch off the power supply.

Result :

The Power of the given experiment is measured by using two wattmeter methods.