DEPARTMENT OF ELECTRICAL ENGINEERING

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GOVERNMENT POLYTECHNIC SHEOHAR

(Department Of Science,Technology & Technical Education)

LAB MANUAL

ELECTRICAL CIRCUIT & MACHINE LAB

SUBJECT CODE :- P2420102

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SHEOHAR (843329)

Practical/Lab Session Outcomes (LSOs)

S.NO	Laboratory Experiment	Lab Session Outcomes
01.	Perform experiment to verify Ohm's law for two different resistors in series and parallel circuits.	1.1. Use multimeter to measure voltage and current. 1.2. Plot the graph between voltage and current.
02.	Measurement of current through the given branch of electric network.	2.1. Construct the resistive circuits on breadboard with appropriate resistors. 2.2. Use a multimeter to measure the voltage across the terminals, the current flowing in the circuit and the resistance of the load.
03.	Measurement of voltage through the given branch of electric network using KVL.	3.1.Construct the resistive circuits on breadboard with appropriate resistors. 3.2. Identify AC/DC supply terminals and tabulate the measured voltage between terminals.
04.	Perform experiment to determine load resistance using maximum power transfer theorem.	4.1. Construct the resistive circuits with appropriate resistors/rheostat. 4.2. Take readings using multimeter or ammeter and voltmeter and calculate the Thevenin resistance and power transfer to the load.
05.	Measurement of current through the given branch of circuit by applying superposition theorem.	5.1. Construct the resistive circuits with appropriate voltage source. 5.2. Measure the current flowing through the circuit.
06.	Perform experiment to Determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem.	6.1. Connect the resistive circuits with appropriate electrical circuit elements. 6.2. Measure the Thevenin equivalent impedance and Thevenin voltage.
07.	Perform experiment to determine equivalent circuit parameter in a given circuit by applying Norton's theorem.	7.1. Construct the resistive circuits on breadboard with appropriate electrical circuit elements.

		7.2. Measure the Norton's equivalent impedance and Norton's current source.
08.	Measurement of power and power factor of single-phase load and plot the graph.	8.1. Measure the basic electrical quantities such as voltage, current and power and power factor for variable R-load. 8.2. Measure the apparent power reading using ammeter and voltmeter.
09.	Plot frequency response of series R-L-C resonant Circuit.	9.1. Assemble the series resonance circuit with appropriate circuit components. 9.2. Measure the frequency using audio frequency generator and record the different readings. 9.3. Calculate the frequency at which voltage attains its maximum value.
10.	Plot frequency response of parallel R-L-C resonant Circuit.	10.1. Measure the value of the resistor R, capacitor and inductor. 10.2. Calibrate the function generator and oscilloscope.
11.	Plot and analyze the transient response of a series R-L circuit.	11.1. Construct the circuit with proper location of supply, switch and load. 11.2. Measure the currents and voltage at different time instants.
12.	Plot and analyze the transient response of a series R-C circuit.	12.1. Assemble the circuit with proper location of supply, switch and load. 12.2.Measure the currents and voltage at different time instants.
13.	Perform experiment to determine different parameters of Two-port network.	13.1. Design the desired network by proper morphology for different two port network parameters. 13.2.Measure the parameters for respective circuit.
14.	Measurement of voltage ratio and current ratio of a given single-phase transformer.	14.1. Identify the terminals of a single-phase transformer. 14.2. Connect Voltmeter and Ammeter to measure voltage and current

15.	Assemble the various parts of a cut section model of a DC Motor.	15.1.Identify the various parts of a DC motor. 15.2.Identify the material of different parts of a DC motor.
16.	Assemble the various parts of a cut section model of a 3-phase induction motor.	16.1. Identify the various parts of a 3-phase induction motor. 16.2. Identify the material of different parts of a 3-phase induction motor.

DEPARTMENT OF ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS

01.	Perform experiment to verify Ohm's law for two different resistors in series and parallel circuits.
02.	Measurement of current through the given branch of electric network.
03.	Measurement of voltage through the given branch of electric network using KVL.
04.	Perform experiment to determine load resistance using maximum power transfer theorem.
05.	Measurement of current through the given branch of circuit by applying superposition theorem.
06.	Perform experiment to Determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem.
07.	Perform experiment to determine equivalent circuit parameter in a given circuit by applying Norton's theorem.
08.	Measurement of power and power factor of single-phase load and plot the graph.
09.	Plot frequency response of series R-L-C resonant Circuit.
10.	Plot frequency response of parallel R-L-C resonant Circuit.
11.	Plot and analyze the transient response of a series R-L circuit.
12.	Plot and analyze the transient response of a series R-C circuit.
13.	Perform experiment to determine different parameters of Two-port network.
14.	Measurement of voltage ratio and current ratio of a given single-phase transformer.
15.	Assemble the various parts of a cut section model of a DC Motor.
16.	Assemble the various parts of a cut section model of a 3-phase induction motor.

EXPERIMENT NO:- 01

AIM:

To verify Ohm’s Law for two different resistors connected in series and in parallel by plotting V-I characteristics.

Apparatus Required:

DC power supply 0-30V, DC Ammeter 0-1A, DC Voltmeter 0-30V,

Rheostat, Two resistors R1 = 100Ω and R2 = 150Ω, Connecting wires, Plug key, Breadboard.

THEORY:

Ohm’s Law: V=IR, where V = potential difference, I = current, R = resistance.

For Series: Equivalent resistance

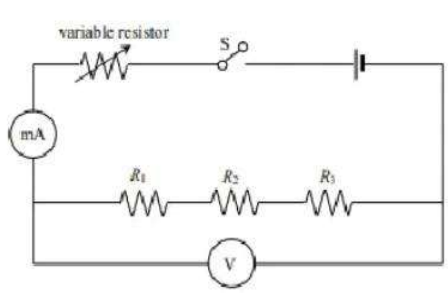
Rs=R1+R2

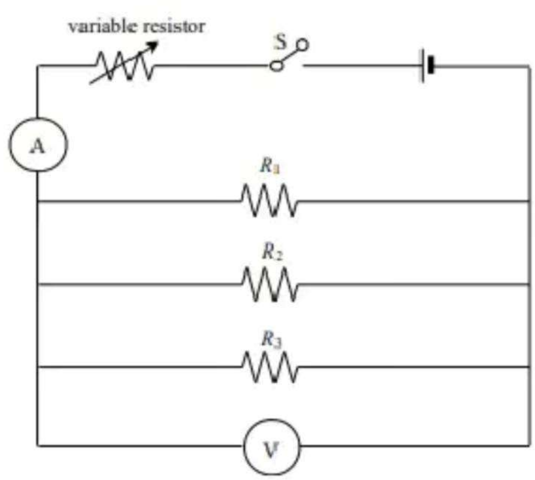
For Parallel: Equivalent resistance

1/Rp=1/R1+1/R2

If the V-I graph is a straight line passing through the origin, Ohm’s Law is verified.

CIRCUIT DIAGRAM:





PROCEDURE:

A. For Series Connection:

1.Connect the two resistors R1 and R2 in series. Connect this combination in series with ammeter, rheostat, battery, and key.

2.Connect a voltmeter in parallel across the series combination of R1 and R2.

3.Close the key and adjust the rheostat to get a small deflection in ammeter and voltmeter.

4.Note the readings of voltmeter V and ammeter I.

5.Increase the voltage in steps by varying the rheostat and take at least 5-6 sets of readings for V and I.

6.Plot a graph between V on Y-axis and I on X-axis. The slope of the graph gives equivalent resistance Rs.

B. For Parallel Connection:

1.Connect the two resistors R1 and R2 in parallel. Connect this parallel combination in series with ammeter, rheostat, battery, and key.

2.Connect a voltmeter in parallel across the parallel combination of R1 and R2.

3. Close the key and take 5-6 sets of readings for V and I by varying the rheostat.

4.Plot a graph between V on Y-axis and I on X-axis. The slope gives equivalent resistance Rp.

OBSERVATIONS:

For Series Combination:

R1 = 100Ω, R2 = 150Ω, Theoretical Rs=250Ω

S.No	Voltage V (Volts)	Current I (Ampere)
1.	2.5	0.010
2.	5.0	0.020
3.	7.5	0.030
4.	10.0	0.040

Mean Rs=250Ω

For Parallel Combination:

Theoretical Rp=100×150/100+150=60Ω

S.no	Voltage V (Volts)	Current I (Ampere)
1.	1.2	0.020
2.	2.4	0.040
3.	3.6	0.060
4.	4.8	0.080

Mean Rp=60Ω

CALCULATIONS:

Plot V vs I graph for both cases. The graph is a straight line passing through origin.

Slope of series graph = Rs = 250Ω

Slope of parallel graph = Rp = 60Ω

RESULT:

1.The V-I graph for both series and parallel combinations is a straight line passing through the origin, which verifies Ohm's Law.

2.Experimental values of equivalent resistance are equal to theoretical values.

Series: Experimental = 250Ω, Theoretical = 250Ω

Parallel: Experimental = 60Ω, Theoretical = 60Ω

3.Hence, Ohm's Law is verified for series and parallel combinations of resistors.

PRECAUTIONS:

1. All connections should be neat, clean, and tight.

2.Zero error in ammeter and voltmeter should be removed before use.

3.Current should not be passed for a long time to avoid heating of resistors.

4.The rheostat should be used properly to vary the current.

EXPERIMENT NO:-02

AIM:

Mesurement of current through the given branch of electric network.(KCL).

APPARATUS REQUIRED:

S No.	Name of the Apparatus	Range	Quantity
01.	RPS	0-15V	1
02.	Resistor	1KiloOhms	3
03.	Ammeter	0-10 mA	3
04.	Bread Board	……	1
05.	Connecting Wire	……	As required

THEORY:

Kirchoff's current law:

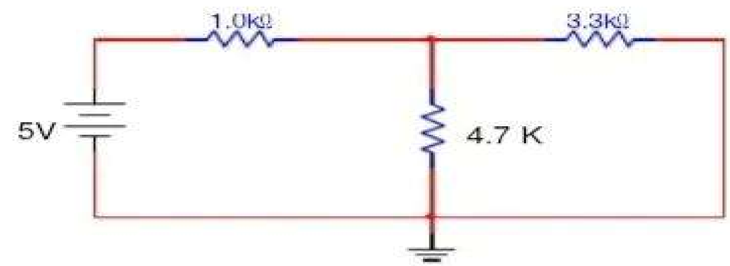
The algebraic sum of the currents entering in any node is Zero.

The law represents the mathematical statement of the fact change cannot accumulate at a node. A node is not a circuit element and it certainly cannot store destroy (or) generate charge. Hence the current must sum to zero. A hydraulic analog sum is zero. For example consider three water pipes joined pn the shape of Y. we defined free currents as following into each of 3 pipes. If we insists that what is always

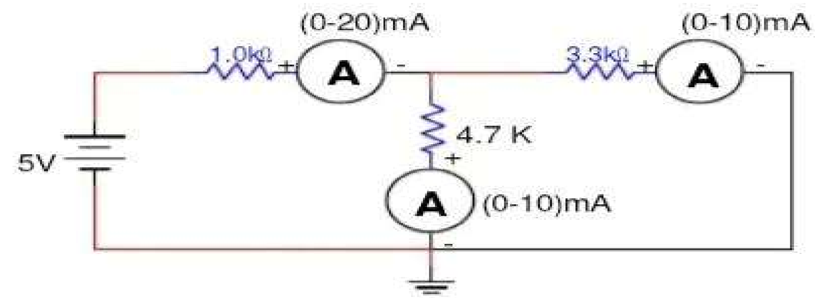
PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Check your connections before switch on the supply.
3. Vary the regulated supply.
4. Measure the current using ammeter.
5. Note the readings in the tabulation.
6. Compare the observation reading to theoretical value.

Kirchoff`s current law



Practical measurement:



TABULATION:

Tabulation:

Voltage	Total current I(mA)	I_1(mA)	I_2(mA)

RESULT:

EXPERIMENT NO :-03

AIM:

Measurement of voltage through the given branch of network using KVL.

APPARATUS REQUIRED:

S No.	Name of the Apparatus	Range	Quantity
01.	RPS	0-15V	1
02.	Resistor	(1,2.2,3.3)KiloOhms	3
03.	Voltmeter	0-20V	3
04.	Bread Board	……	1
05.	Connecting Wire	……	As required

THEORY:

kirchoff's voltage law

The algebraic sum of the voltage around any closed path is zero.

PROCEDURE:

1. Connections are made as per the circuit diagram.

2. Check your connections before switch on the supply. 3. Vary the regulated supply.

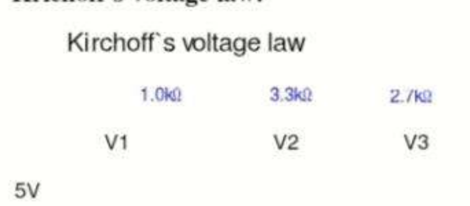
4. Measure the voltage using voltmeter.

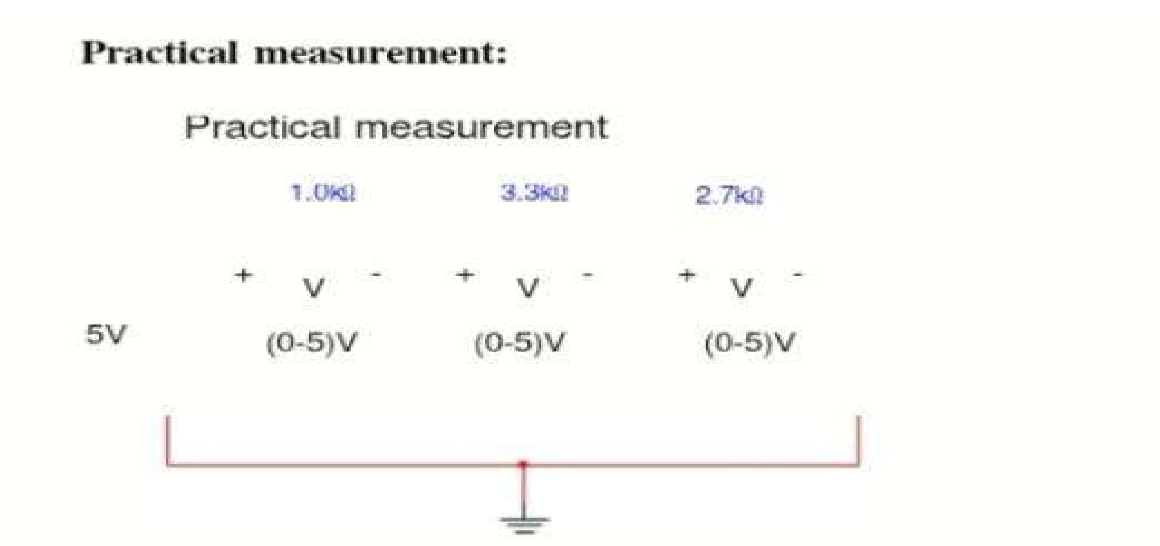
5. Note the readings in the tabulation.

6. Compare the observation reading to theoretical value.

Circuit diagram

Krichoff's voltage law:





TABULATION:

Voltage (V)	V1 (Volts)	V2 (Volts)	V3(Volts)

CALCULATIONS:

RESULTS:

Thus the voltage in beanch verified by KVL.

EXPERIMENT NO :-04

AIM:

Perform experiment to determine load resistance using maximum power transfer theorem.

APPARATUS REQUIRED:

S No.	Name of the Apparatus	Range	Quantity
01.	RPS	0-30V	1
02.	Resistor	(1,2.2,3.3)KiloOhms	1
03.	Ammeter	0-10mA	1
04.	Bread Board	……	1
05.	Connecting Wire	……	As required
06.	DRB	0-10 KiloOhms	1

THEORY:

Maximum power transfer theorem:

Maximum power transfer to the load resistor occurs when it has a value equal to the resistance of the network looking back at it from the load terminals.

PROCEDURE:

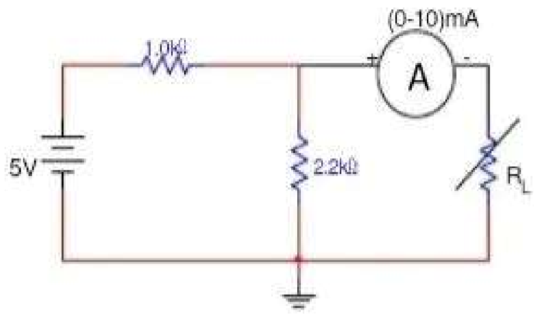
1. Connections are given as per the circuit diagram.

2. By giving various values of the resistance in DRB, note the ammeter reading.

3. Calculate the power and plot the power Vs resistance graph.

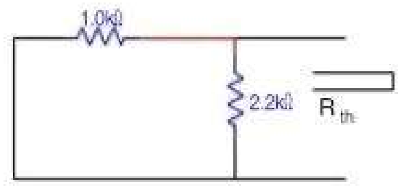
4. Note the maximum power point corresponding resistance from the graph.

Circuit diagram
Max power transfer theorem



Theoretical calculation

To find R_{th}



Theoretical value:

Tabulation:

Resistance (R_L)	Current I(mA)	Power $=I^2R_L$

Theoretical calculation:

RESULT:

Thus the value of unknown resistance in which the maximum power is transferred to the load was found.

Theoretical load resistance =
Practical load resistance =
Maximum power =

EXPERIMENT NO :-05

AIM:

Measurement of current through the given branch of circuit by applying superposition theorem.

APPARATUS REQUIRED:

S No.	Name of the Apparatus	Range	Quantity
01.	RPS	0-15V	1
02.	Resistor	(1000,220,470)Ohms	1
03.	Ammeter	0-10mA	1
04.	Bread Board	……	1
05.	Connecting Wire	……	As required

THEORY:

Superposition theorem

In a linear circuit containing more than one source, the current that flows at any point or the voltage that exists between any two points is the algebraic sum of the currents or the voltages that would have been produced by each source taken separately with all other sources removed.

PROCEDURE:

1. Connections are made as per the circuit diagram.

2.Check your connections before switch on the supply.

3. Determine the current through the load resistance.

4. Now one of the sources is shorted and the current flowing through the resistance I measured by ammeter.

5. Similarly, the other source is shorted and the current flowing through the resistance I measured by ammeter.

6. Compare the value obtained with the sum of I,&I2 should equal to I

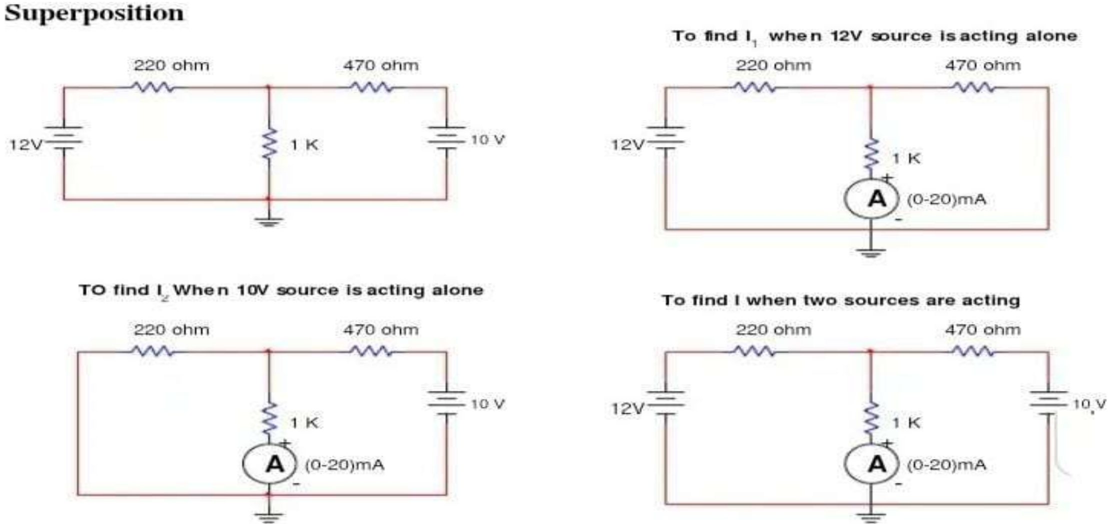
7. Compare the observation reading to theoretical value.

8. switch off the supply

9. Disconnect the circuit.

Circuit diagram

Superposition



Tabulation:

V(volt)		I_1(mA)		I_2(mA)		I(mA)	
V1	**V2**	theoretical	practical	theoretical	practical	theoretical	practical

CALCULATION:

RESULT:

Thus the superposition theorem was verified.

EXPERIMENT NO :-06

AIM:

Perform experiment to Determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem.

APPARATUS REQUIRED:

S No.	Name of the Apparatus	Range	Quantity
01.	RPS	0-15V	1
02.	Resistor	(1,2.2,3.3)KiloOhms	1
03.	Ammeter	0-5mA	1
04.	Bread Board	……	1
05.	Connecting Wire	……	As required
06.	Voltmeter	0-5 V	1

THEORY:

Thevenin's theorem:

Any linear active network with output terminals can be replaced by a single voltage source Vth in series with a single impedance Zth. Vth is the Thevenin` s voltage. It is the voltage between the terminals on open circuit condition, Hence it is called open circuit voltage denoted by Voc. Zth is called Thevennin` s impedance. It is the driving point impedance at the terminals when all internal sources are set to zero too.

If a load impedance Z is connected across output terminals, we can find the current through it I = Vth/ (Zth+ZL).

PROCEDURE:

1. Connections are made as per the circuit diagram.

2. Check your connections before switch on the supply. 3. Find the Thevenin's voltage (or) open circuit voltage.

4. Replace voltage source by internal resistor.

5. Determine the Thevenin's resistance.

6. Find I by using Thevenin's formula.

7. Compare the observation reading to theoretical value. 8. switch off the supply

9. Disconnect the circuit.

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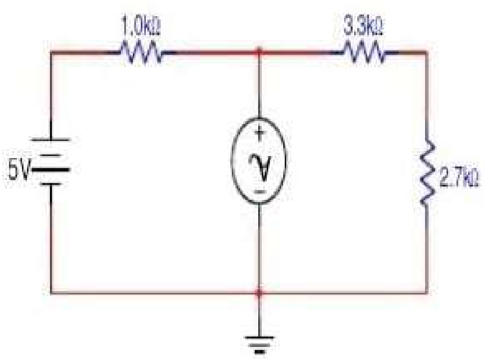
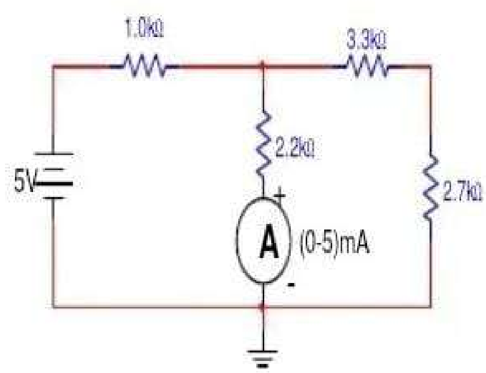
CIRCUIT DIAGRAM

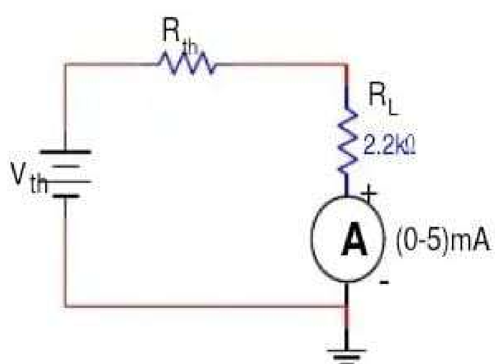
To find V_{th}



To find I_L



Equivalent ciruitl



Tabulation

V_{th}		R_{th}		I_L(mA)	
theoretical	practical	theoretical	practical	theoretical	practical

Calculation:

RESULT:

Thus the Thevenin's theorem was verified.

Theoretical:

V_{th} =

R_{th} =

I_L =

Practical:

V_{th} =

R_{th} =

I_L =

EXPERIMENT NO :-07

AIM:

Perform experiment to determine equivalent circuit parameter in a given circuit by applying Norton's theorem.

APPARATUS REQUIRED:

S No.	Name of the Apparatus	Range	Quantity
01.	RPS	0-15V	1
02.	Resistor	(10,5.6,6,8.2)KiloOhms	Each 1
03.	Ammeter	0-10mA,mc	1
04.	Bread Board	……	1
05.	Connecting Wire	……	As required

THEORY:

Norton's theorem:

Any linear active network with output terminals can be replaced by a single current source. I se in parallel with a single impedance Zth. Ise is the current through the terminals of the active network when shorted. Z th is called Thevennin` s impedance.

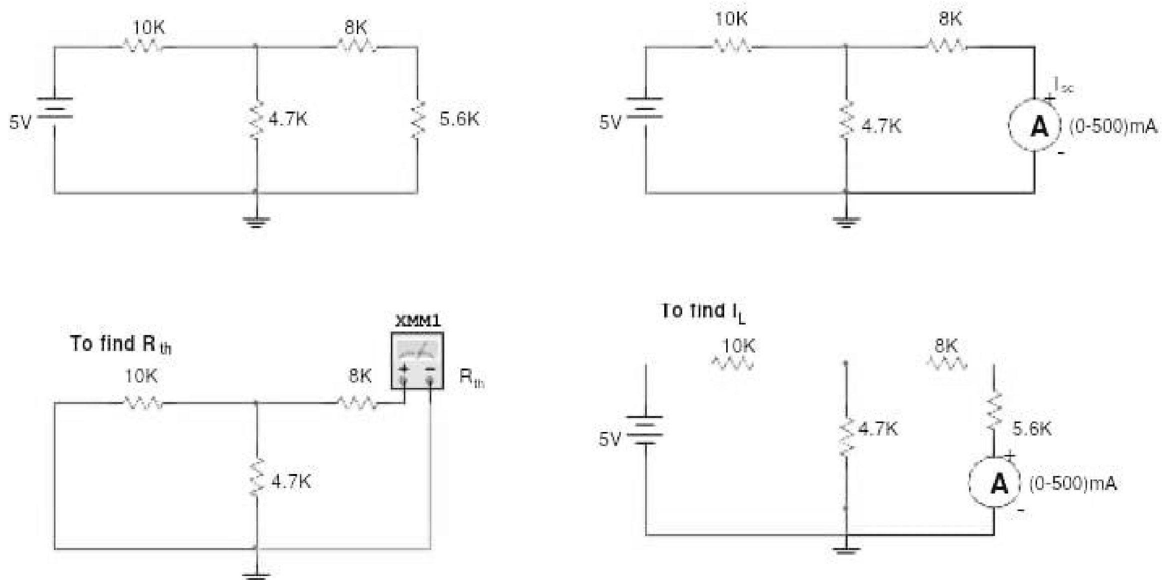
Current through RL= Isc Zth/(Zth+ZL)

PROCEDURE:

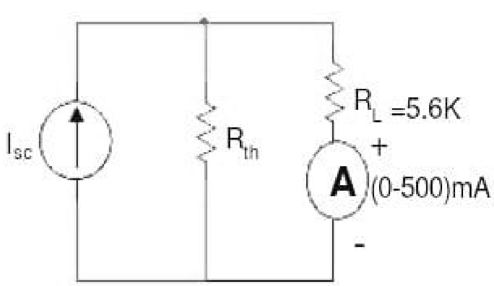
1. Connections are made as per the circuit diagram.
2. Check your connections before switch on the supply.
3. Find the Norton's current (or) short circuit current in load resistance.
4. Replace voltage source by internal resistor.
5. Determine the equivalent's resistance.

6. Find I by using Norton's formula.
7. Compare the observation reading to theoretical value.
8. switch off the supply
9. Disconnect the circuit.

Circuit diagram



Norton`s Equivalent circuit



TABULATION:

Theoretical		Practical	
I_{sc}	R_{th}	I_{sc}	R_{th}

CALCULATION:

RESULT:

Thus the Norton's theorem was verified.

Theoretical:

Isc =

R_{th} =

I_L =

Practical:

Isc =

R_{th} =

I_L =

EXPERIMENT NO :-08

AIM:

Measurement of power and power factor of single-phase load and plot the graph.

APPARATUS REQUIRED:

S.No	Name Of Apparatus	Specification	Quantity
1.	1 Phase auto x-mer	5KVA	1Nos
2.	Voltmeter	0-250V	1Nos
3.	Wattmeter	0-1500 W	1Nos
4.	Ammete	0-5 A	1Nos
5.	Rheostat	0-80 Ohm	1Nos
6.	Inductor		1Nos
7.	Capacitor		1Nos
8.	Connecting Wires	Pvc	1 Nos

CIRCUIT DIAGRAM :

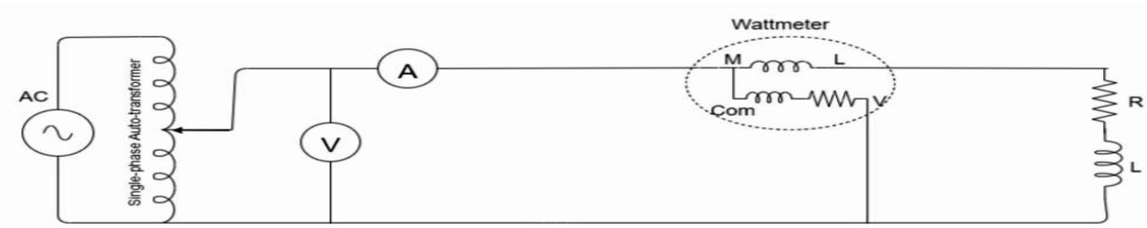


Fig. No. 10.1 : Circuit diagram for measurement of power and power factor with R-L Load.

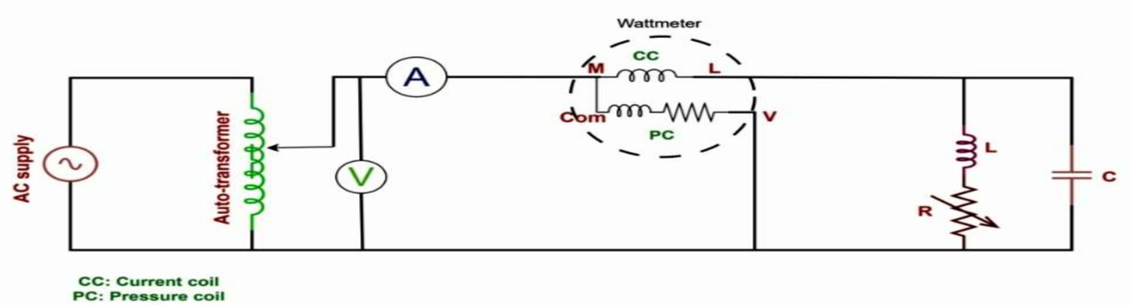


Fig. No. 10.2: Circuit diagram for Improvement of power factor.

THEORY:

In R-L series AC circuit a resistor of resistance R ohm, and Inductor of inductance L henry are connected across single phase ac supply of V volts as shown in above fig.

Power consumed by the Inductive load is given by

$$P = VICos\phi$$

$$Power\ factor\ (Cos\phi)\ = \frac{P}{VI}$$

where, P is active power in watt, V is supplied

voltage in volts, I is current flowing through the circuit elements in Amp.

thus, by using above formula the power consumed by the load and power factor can be determined.

PROCEDURE:

1. Connect all the instruments as per circuit diagram given above.
2. Before switch on the main power supply make sure that single-phase auto transformer knobe is at zero position.
3. Now slowly increase the supply voltage to the circuit after giving supply to the single- phase auto-transformer.
4. Take all the corresponding readings of the connected instruments in the circuit as per observation table.
5. Now power factor Cos and % error as per formula given in observation table.

6. Now connect the capacitor in parallel with the R-L load and take readings as per observation table and analyze the power factor. (Fig. No. 10.2).

PRECAUTION:

1. Don't switch on power supply without concerning teacher.

2. Single phase autotransformer must be kep at minimum potential point before switch on the experiment.

OBSERVATION :

S No.	Voltage	Current	Power	Power Factor

RESULT :

EXPERIMENT NO :-09

AIM:

Plot frequency response of series R-L-C resonant Circuit.

OBJECTIVES:

To obtain frequency response of series RLC circuit.

Magntitude of input impedance versus frequency.

Phase of input impedance versus frequency.

To observe circuit behave at resonance.

PRE LAB WORKS:

Study the phase relationship beyween voltage and current for an ideal

Resistor

Inductor

And Capacitor

PROCEDURE:

1.Determine the resonant frequency (fr)of the RLC circuit using.

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

2.Connect the resistor(R) ,inductor(I) and capacitor (C) in series and obtain frequency behave as mentioned below.

Fig.1 Series R-L-C circuit

- Exite the RLC circuit by a sinusoidal generator.
- For a sinusoidal voltage signal of certain frequency ,measure the magnitude of input voltage and current.Further,measure the phase angle between the input voltage and current.Record whether the current drawn from the source lags or leads with respect to input voltage.
- Then,determine the magnitude of input impedamce.phase of impedance is the positive value of phase difference between current and voltage,for lagging current.
- Determine the input impedance at different frequencies.
- Sketch both the magnitude and phase plots of input impedance.

3. From the frequency response plots, identify the resonant frequency at which the input voltage and input current are in phase. Does this identified value match with the estimated value (as obtained from step 1)?

4. At resonance, it behaves like a resistive circuit. Hence, the current drawn from the source at resonance can be expressed as,

$$I_s = \frac{V_s}{R}$$

Does your observation (i.e. current measured at resonant frequency) validate the above expression? If not, how do you account for this deviation?

Plot the graph:

RESULT:

EXPERIMENT NO :-10

AIM:

Plot frequency response of parallel R-L-C resonant Circuit.

OBJECTIVES:

To obtain frequency response of parallel RLC circuit.

Magntitude of input impedance versus frequency.

Phase of input impedance versus frequency.

To observe circuit behave at resonance.

PRE LAB WORKS:

Study the phase relationship beyween voltage and current for an ideal

Resistor

Inductor

And Capacitor

PROCEDURE:

1. Determine the resonant frequency (fr) of the parallel RLC circuit using,

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

2. Connect the resistor (R), inductor (L) and capacitor (C) in parallel (as shown in Fig.1) and obtain its frequency behavior as mentioned below. Also connect a small value resistor (5 ohms) for the purpose of measuring the input current.

Excite the RLC circuit by a sinusoidal generator.

For a sinusoidal voltage signal of certain frequency, measure the magnitude of input voltage and current. Further, measure the phase angle between the input voltage and current. Record whether the current drawn from the source lags or leads with respect to input voltage.

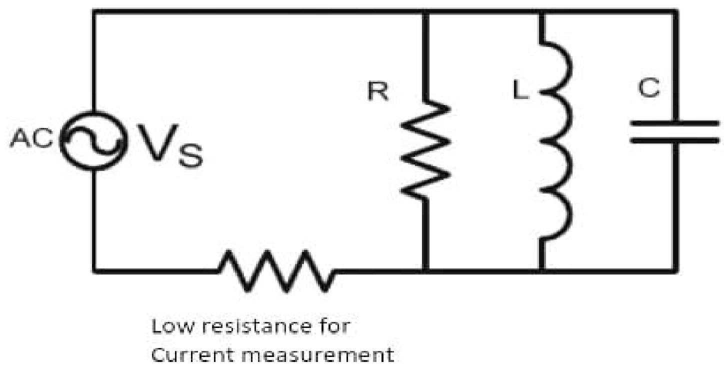


Fig.2 Parallel R-L-C circuit

Then, determine the magnitude of input impedance (the ratio of input voltage to input current). Phase of impedance is the positive value of phase difference between current and voltage, for lagging current (it is the negative value of phase difference between current and voltage for leading current).

Determine the input impedance at different frequencies (ranging from low to high values of frequencies with the resonant frequency being at the centre).

Sketch both the magnitude and phase plots of input impedance (magnitude Vs frequency, phase Vs frequency).

3. From the frequency response plots, identify the resonant frequency at which the input voltage and input current are in phase. Does this identified value match with the estimated value (as obtained from step 1)?

4. At resonance, it behaves like a resistive circuit. Hence, the current drawn from the source at resonance can be expressed as,

$$I_s = \frac{V_s}{R_{eff}}$$

Does your observation (i.e. current measured at resonant frequency) validate the above

expression? If not, how do you account for this deviation?

PLOT THE GRAPH:

RESULT:

EXPERIMENT NO :-11

AIM:

Plot and analyze the transient response of a series R-L Circuit.

OBJECTIVE:

- To observe the transient response of RL Circuit.
- Proteus.

HARDWARE:

- Breadboard
- Resistor
- Inductor

THEORY:

This lab is similar to the RC Circuit Lab except that the Capacitor is replaced by an Inductor. In this experiment, we apply a square waveform to the RL circuit as shown in fig.1 to analyze the transient response of the circuit. The pulse-width relative to the circuit's time constant determines how it is affected by the RL circuit.The time constant of an RL circuit is the equivalent inductance divided by the Thévenin resistance as viewed from the terminals of the equivalent inductor.

$$T = L/R \ldots\ldots\ldots\ldots.(1)$$

In R-L circuit, voltage across the inductor decreases with time while in the RC circuit the voltage across the capacitor increased with time. Thus, current in an RL circuit has the same form as voltage in an RC circuit. They both rise to their final value exponentially according to 1-e.

The expression for the current build-up across the Inductor is given by.

$$i_r(t) = R/V\left(1 - e^{\frac{R}{L}t}\right)\ t \geq 0 \ \ldots\ldots\ldots\ (2)$$

Where, V is the applied square wave voltage for t≥0. The response curve is increasing and is shown in fig.4.1.

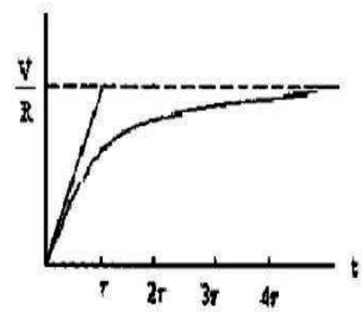


Fig.4.1

The expression for the current decay across the Inductor is given by:

$$i_L(t) = i_0 e^{\frac{R}{L}t} \qquad t \geq 0 \quad \ldots\ldots\ldots (3)$$

where,

i_0 is the initial current stored in the inductor at $t = 0$

$L/R = \tau$ is time constant.

The response curve is a decaying exponential and is shown in figure 4.2.

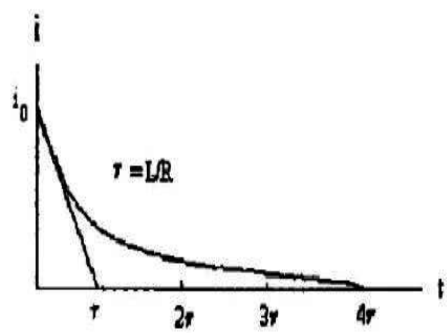
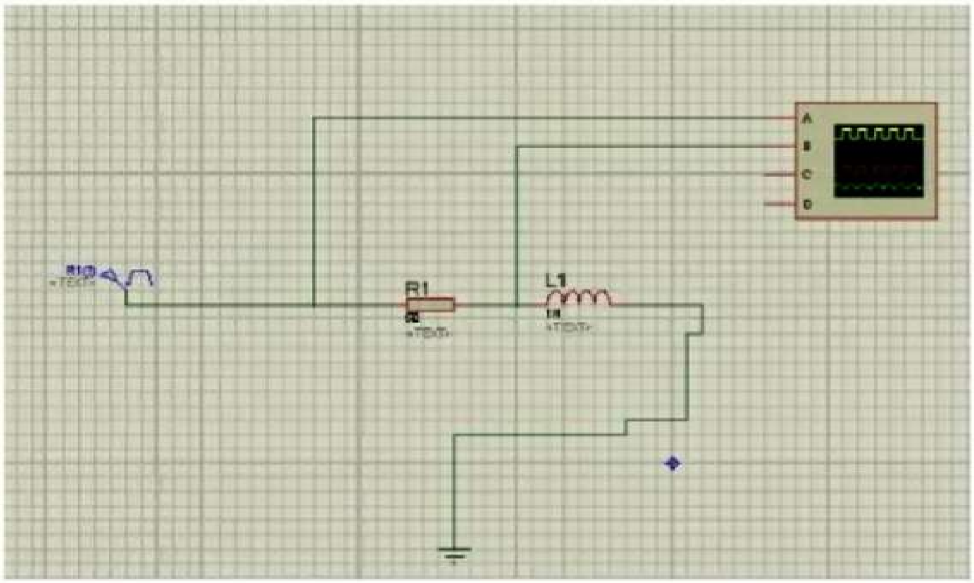


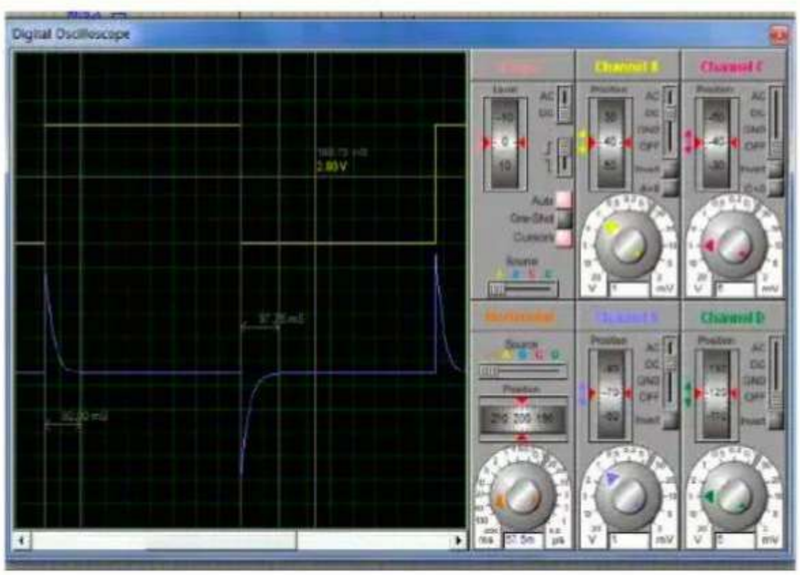
Fig.4.2

Since it is not possible to directly analyze the current through Inductor on a Scope, we will measure the output voltage across the Resistor *RL*. The resistor voltage waveform should be similar to inductor current as $V_R = I_L R_L$.

Performance on Proteus:



Result:



EXPERIMENT NO :-12

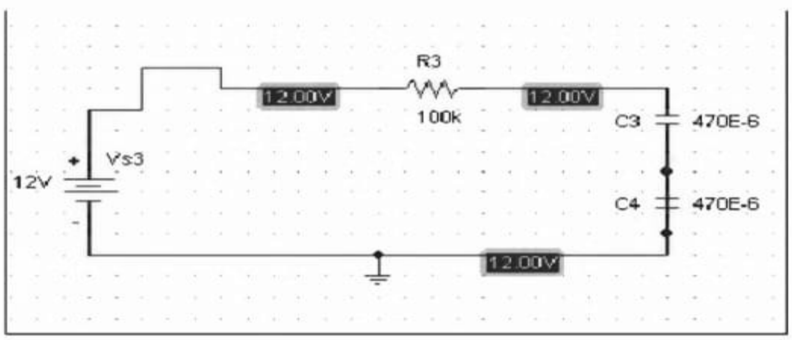
AIM:

Plot and analyze the transient response of a series R-C Circuit.

APPARATUS:

- V(dc)=12V
- Resistor: 68 & 100 KiloOhms
- Digital Multimeter
- Electrolytic Capacitor 470 Microfarad

Transient response of RC circuit when capacitors are in series



Capacitor in Series

1. RC circuit is constructed by using one R = 100 kΩ and two C = 470 μF. So, the capacitors are in series.
2. The total capacitance for series capacitor ($1/C_T = 1/C_1 + 1/C_2$) and the transient period 5τ is calculated. The charging and discharging of the capacitor will be stabilized at this period.
3. Step 3 and 4 in the first experiment is being repeated.
4. Step 5 is being repeated and that value is recorded in **Table 4-3**.
5. Step 6 and 7 is being repeated and that value is recorded in **Table 4-3**.

Table of Results

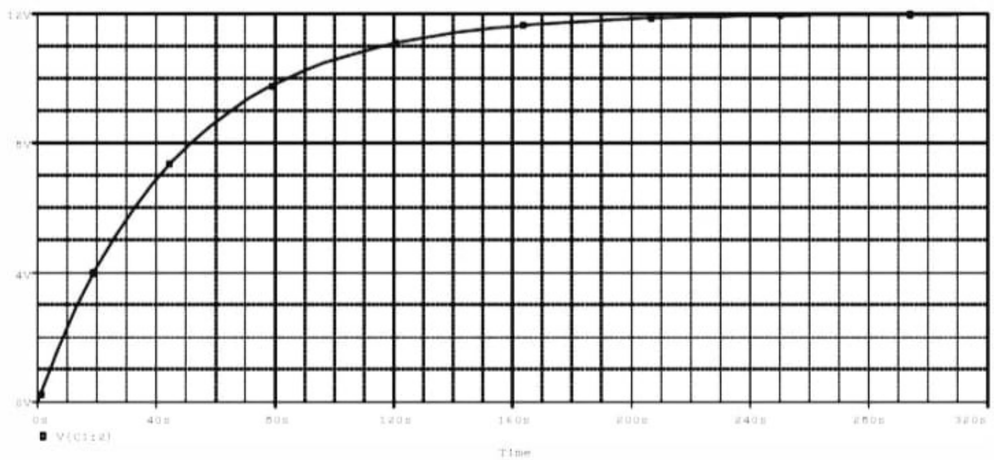
Time constant	**R** = 68 kΩ	**C** = 468 μF	= 31.82 s
	R = 100 kΩ	**C** = 468 μF	= 46.8 s

Table 4-1

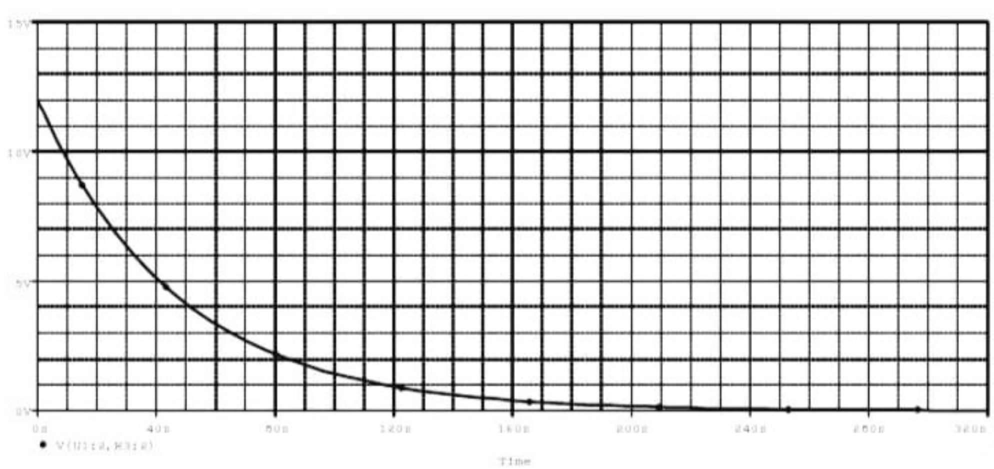
Time Intervals (s)	Vc R = 68 k		Vc R = 100 k	
	Charge	**Discharge**	**Charge**	**Discharge**
0	0.00	11.91	0.00	11.84
20	4.87	7.36	3.628	8.69
40	7.76	4.67	6.10	6.27
60	9.44	3.024	7.84	4.60
80	10.41	2.011	8.02	3.394
100	10.99	1.325	9.86	2.494
120	11.34	0.866	10.44	1.852
140	11.55	0.596	10.86	1.371
160	11.68	0.406	11.14	1.025
180	11.76	0.276	11.35	0.764
200	11.81	0.190	11.49	0.578
220	11.84	0.173	11.60	0.434
240	11.87	0.132	11.67	0.327

Table 4-2

Charge Graphs:



Discharge graph



Discussion & Conclusion:

The function of a capacitor is to store an electrical charge and energy. The voltage across the capacitor is related to the charge by the equation **$V = Q / C$** for steady state values, or it can be expressed as an instantaneous value **$dv = dq / C$** Capacitor also often used as a filter in the circuit.

When the time, $t = 0$, the voltage across the capacitor is zero because there can't be an instantaneous change in voltage across the capacitor. After five time constant, **5τ** (**$\tau = RC$**), the capacitor will be mostly charge or discharge where it also call as the **transient period**.

Based on the first test in this experiment, we discovered that the capacitor in the circuit which has small value of resistor is charged and discharged faster than the one with greater value of resistor. According to the formula of transient period, **5τ (τ = RC),** the smaller the value of the resistor, the greater the transient period becomes thus more time is needed for the capacitor to fully charged or discharged and vice versa.

EXPERIMENT NO :-13

AIM:

Perform experiment to determine different parameters of Two port Nerwork.(We consider ABCD Parameter of Two port network).

APPARATUS REQUIRED Power Supply, Bread Board, Five resistances, Connecting Leaas, Voltmeter, and Ammeler,

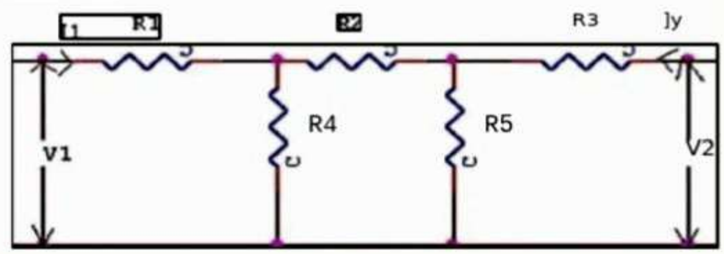
THEORY ,ABCD parameters are widely used in analysis of power Wansmission engineering where they are termed as "Circuit Parameters". ABCD parameters are also known as "Transmission Parameters". In these parameters, the voltage & current at the sending end terminals can be expressed in terms of voltage & current at the receiving end, Thus,

V, = AV 2 B (- 2)

1, = CV2 D (-It)

Here *A" is called reverse voltage ratio, "B" is called transfer impedance "C" is culled transfer admittance & "D" is called reverse current ratio.

CIRCUIT DIAGRAM



PROCEDURE

a) Corinect the circuit as shown in fig & switch 'ON' the experimental board.
b) First open the O/P terminal & supply 5V to I/P terminal, Measure O/P voltage & I/P current
c) Secondly, short the O/P terminal & supply 5V to I/P terminal, Measure I/P & O/P current using multi-meter,
d) Calculate the A, B, C, & D parameters using the Eq. (1) & (2),
c) Switch 'offi the supply after taking the readings.

OBSERVATION TABLE

S.No	When O/P is open ckt			When OIP is short ckt		
	V i	Vi	I[	V i	!2	I1

SIMPLE CALCULATION

(l)When O/P is open circuited i,e. J2 - 0

A = V ,/V2 C ' JI /J2

(2) When O/P is short circuited i,e. J2 0

B = -V,/It D = -It /It

RESULT/CONCLUSION: The ABCD-parameters of the two-port network hns been calculated and verified.

DISCUSSION: ABCD parameters are transmission parameters.

PRECAUTIONS:

a) Make the connections according to the circuit diagram. Power supply should be switched off,

b) Connections should be tight.

c) Note the readings carefully,

EXPERIMENT NO :-14

AIM:

Measurement of voltage ratio and current ratio of a given single-phase transformer.

APPARATUS REQUIRED:

S No.	Name of the Apparatus	Range	Quantity
1	1-ϕ Transformer	1KVA, 230V/230V	1
2	Auto transformer	1KVA, Input 0-230, Output 0-270V	1
3	Voltmeter	0-300V	2
4	Voltmeter	0-500V	1
5	Connecting wire	-	As required

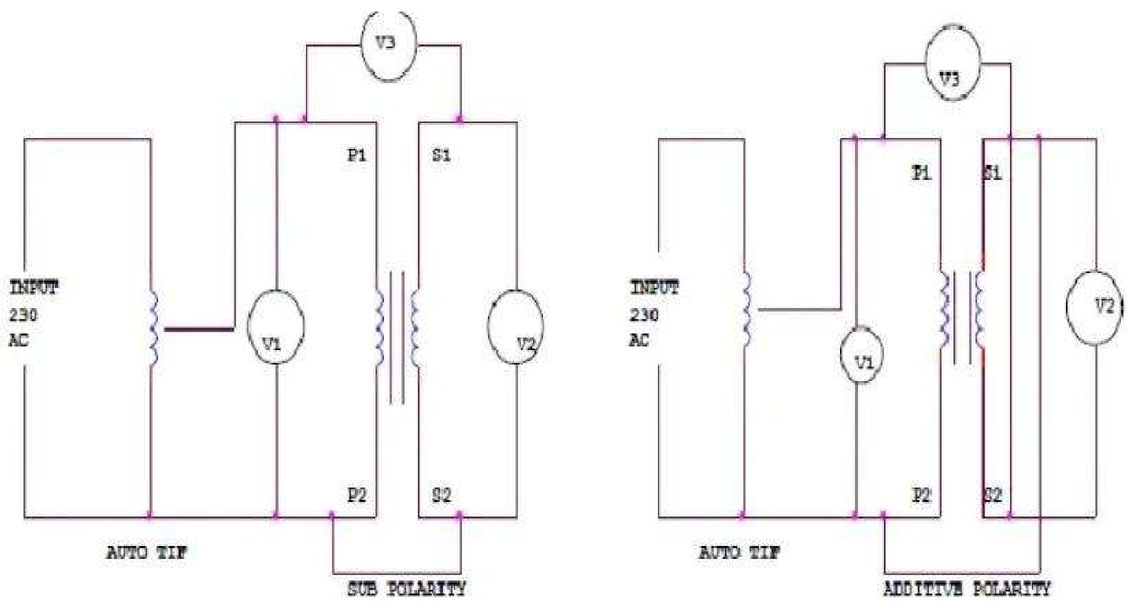
THEORY:

It is essential to know the relative polarity at any instant of primary and secondary terminals for making correct connections. When the two transformers are to be connected in parallel to share the load on the system. The marking is correct if voltage V3 is less than V1, such a polarity is termed as subtractive polarity. The standard practice is to have subtractive polarity because it reduces the voltage stress between adjacent loads. In case V3 > V1, the EMF induced in primary and secondary have additive relation and transformer is said to have additive polarity.

TRANSFORMER:

Electrical power transformer is a static device which transforms electrical energy from one circuit to another without any direct electrical connection and with the help of mutual induction between two windings. It transforms power from one circuit to another without changing its frequency voltage level. This is a very short and simple definition of transformer, as we will go through this portion of tutorial related to electrical power transformer, we will understand more clearly and deeply "what is transformer ?" and basic theory of transformer.

CIRCUIT DIAGRAM:



OBSERVATION TABLE:

SUB-POLARITY

S. NO.	V_1	V_2	$V_3=V_2-V_1$

ADD-POLARITY

S.NO.	V_1	V_2	$V_3=V_1+V_2$

TURN RATIO

S.NO.	V_1	V_2	Turns Ratio V_1/V_2

CALCULATION:

RESULT:

IF V2>V1 then transformer is step up otherwise step down.

DISUSSION:

PRECAUTION:

- ALL connection should be tight and right.
- Do not touch live wire.
- Take reading be carefully.

EXPERIMENT NO :-15

AIM:

Assemble the various part of a cut section model of a DC motor.

APPRATUS REQUIRED:

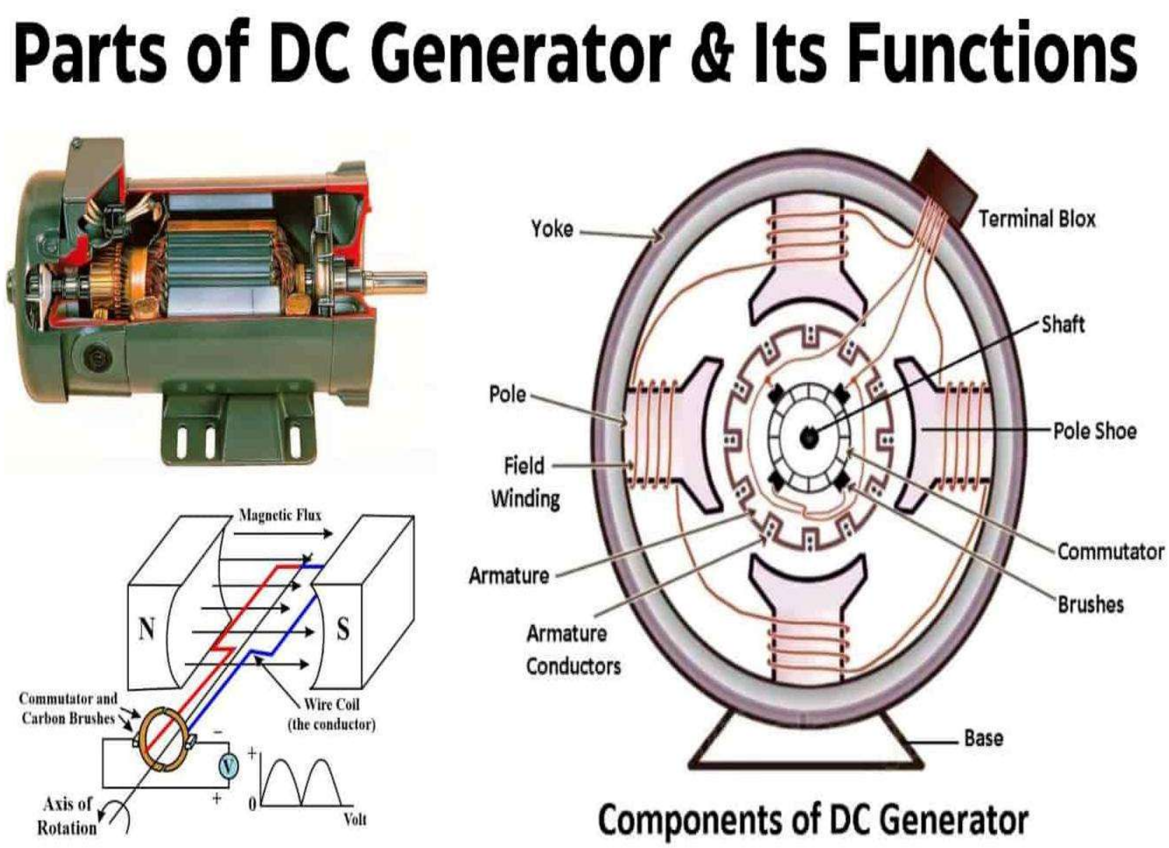
DC Motor

Skrew Driver

Plier

Hammer

DC MOTOR CONSTRUCTION:



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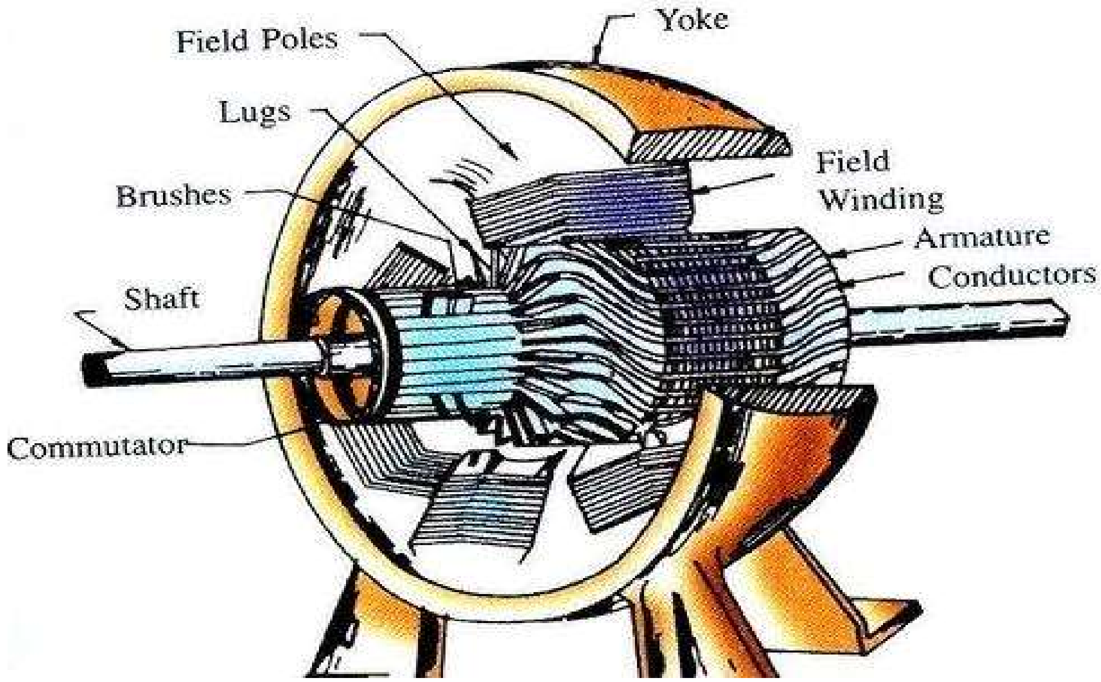
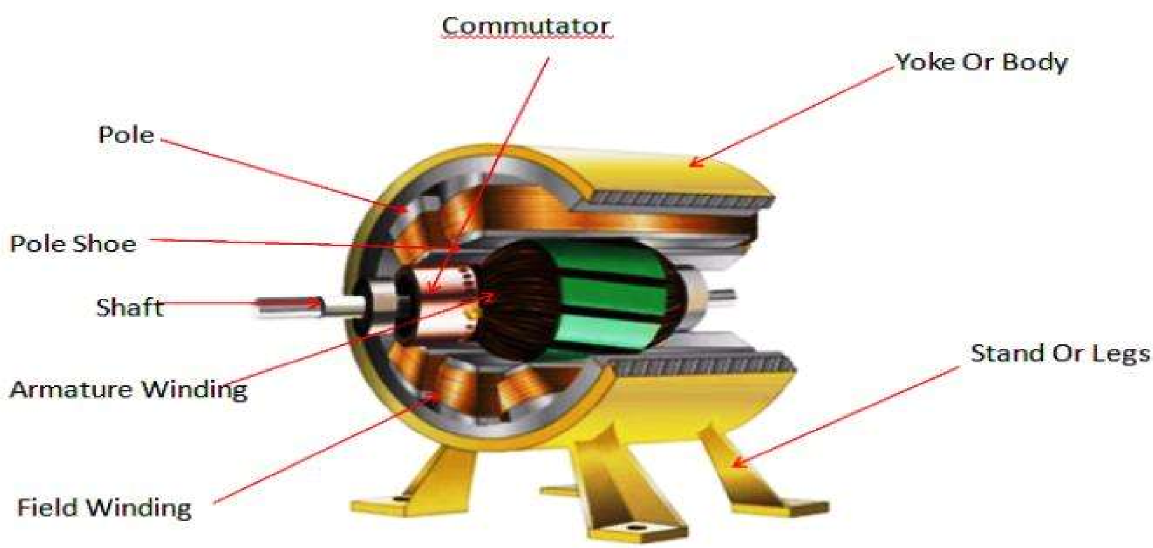




Parts Of DC Machine

CUT SECTION OF DC MACHINE DESCRIPTION:

1. Yoke / Frame:

Outer body of the motor. Made of cast iron or steel. Supports all parts and provides path for magnetic flux.

2. Pole:

Electromagnets fitted inside the yoke. Copper winding is wound on it. Produces main magnetic field.

3. Pole Shoe:

Expanded part of the pole. Spreads magnetic flux uniformly over armature and supports field winding.

4. Stator:

Stationary part of motor. Consists of Yoke + Poles + Pole Shoes + Field Winding. Does not rotate.

5. Rotor / Armature:

Rotating part of the motor. Mounted on shaft. Has slots for armature winding. Produces torque when current flows.

6. Field Winding:

Copper wire wound on poles. Becomes magnet when DC supply is given.

7. Armature Winding:

Copper winding placed in rotor slots. Current in this winding makes the motor rotate.

8. Commutator:

Copper segments mounted on rotor shaft, insulated from each other. Reverses current direction in each half rotation to keep rotor moving in same direction.

9. Brush / Carbon Brush:

Made of carbon or graphite. Presses against commutator with spring. Supplies DC current from outside to rotating armature.

10. Shaft:

Steel rod at the center of rotor. Transmits mechanical power to load. Pulley is mounted on it.

11. Bearings:

Fitted on both sides of shaft. Reduces friction and helps shaft to rotate smoothly.

12. End Covers:

Covers on both ends of motor. Hold bearings in position and protect internal parts from dust.

RESULT:

PRECAUTION:

EXPERIMENT NO :-16

AIM:

Assemble the various part of a cut section model of a 3- Phase induction motor.

APPRATUS REQUIRED:

3-Phase induction motor

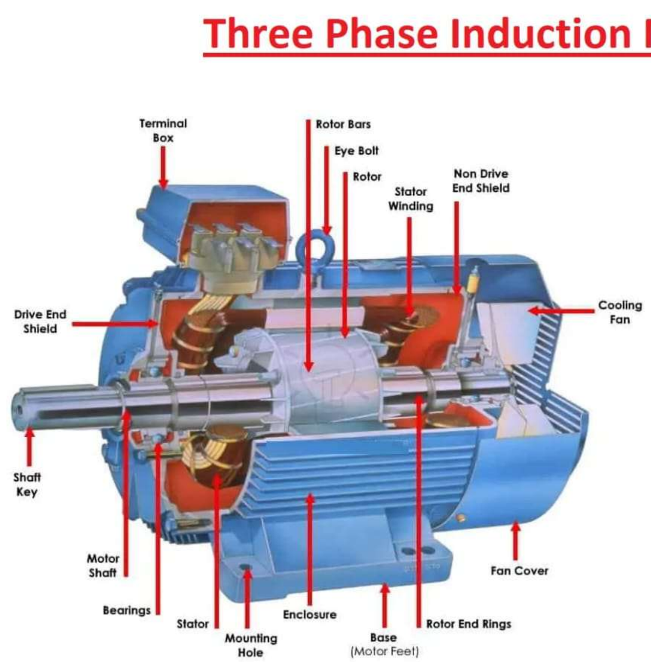
Screw Driver

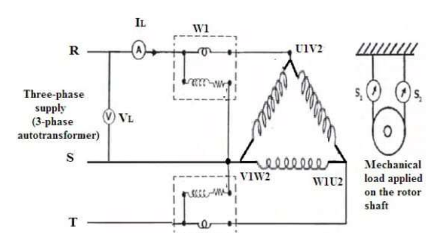
Plier

Hammer

CUT SECTION OF MACHINE:

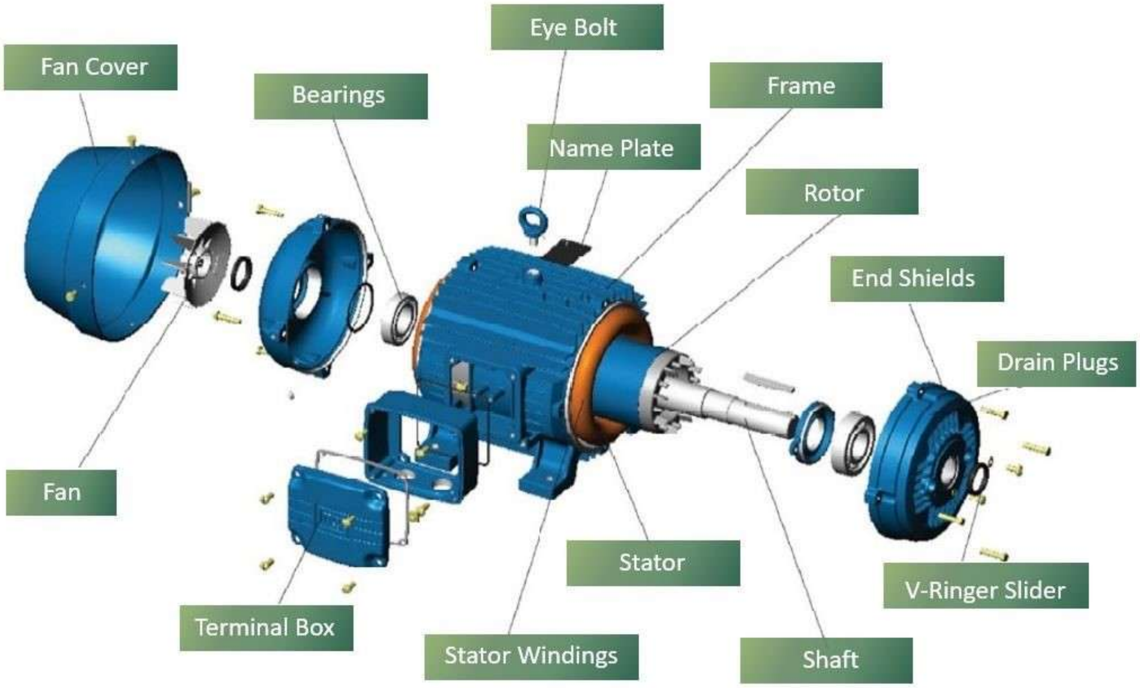
3 Phase induction motor:





EACH PARTS OF 3 PHASE INDUCTION MOTOR AND ITS TYPE:

DEPARTMENT OF ELECTRICAL ENGINEERING



1. Stator:

Stationary outer part of motor. Has a steel frame, laminated core, and 3-phase winding in slots. Gets 3-phase AC supply and produces rotating magnetic field.

2. Stator Core: Made of laminated steel sheets. Reduces eddy current loss. Carries alternating magnetic flux.

3. Stator Winding: 3-phase copper winding placed 120° apart in stator slots. Connected in Star or Delta. Produces RMF when 3-phase supply is given.

4. Rotor: Rotating inner part mounted on shaft. Placed inside stator. Rotates due to induced current from stator RMF. Speed is less than synchronous speed.

5. Shaft: Steel rod at center of rotor. Transmits mechanical power to load.

6. Air Gap: Small gap between stator and rotor, about 0.4mm to 4mm. Magnetic flux crosses this gap to link rotor.

7. Frame / Yoke: Outer body of motor made of cast iron. Supports stator core and protects inner parts.

8. Bearings: Fitted on both ends of shaft. Allows smooth rotation of rotor with minimum friction.

9. End Covers / End Shields: Fitted on both sides of frame. Hold bearings and enclose the motor.

10. Fan: Fitted on shaft behind rear end cover. Cools the motor during operation.

11. Terminal Box: Fitted on frame. Contains 6 terminals for 3-phase stator winding connections.

TYPES OF 3-PHASE INDUCTION MOTOR:

Based on Rotor Construction:

1. Squirrel Cage Induction Motor: Rotor: Has aluminum or copper bars shorted by end rings. Looks like squirrel cage. No winding, no slip rings.

Features: Simple, rugged, cheap, low maintenance, high starting current, no external resistance possible.

Use: Lathes, drills, fans, pumps. About 90% motors are this type.

2. Slip Ring / Wound Rotor Induction Motor:Rotor: Has 3-phase winding connected in star. Ends connected to 3 slip rings on shaft.

Features: Costly, high maintenance due to brushes. External resistance can be added for high starting torque, speed control.

Use: Lifts, cranes, conveyors where high starting torque needed.

RESULT:

PRECAUTION: