LABORATORY MANUAL
BASIC ELECTRICAL ENGINEERING LAB
for
(I& II-SEM) B.E Common to All Branches

DEPARTMENT OF ELECTRICAL ENGINEERING

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ELECTRICAL ENGINEERING DEPARTMENT

Name of the Experiments

1. Verification of KVL and KCL, superposition theorem (with dc excitation)
2. Verification of Thevenin's and Norton's theorems (with dc excitation)
3. Sinusoidal steady state response of R-L, and R-C circuits –impedance calculation and verification. Observation of phase differences between current and voltage. Power factor calculation
4. Measurement of phase voltage/current, line voltage/current and power in a balanced three-phase circuit connected in star and delta
5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
6. Power factor improvement of induction motor using static capacitors
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
8. Magnetization curve of a separately excited D.C generator.

EXPERIMENT 1 (a)

VERIFICATION OF KCL

AIM: To verify Kirchhoff's current law for the given circuit

APPARATUS REQUIRED:

Sl.No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-30V)	1
2	Resistance	220Ω,470Ω,680Ω	3
3	Ammeter	(0-200mA)MC	3
4	Voltmeter	(0-30V)MC	3
5	Connecting wires	--	Required

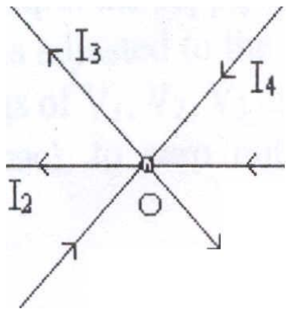
THEORY:-

Kirchhoff's Current Law:

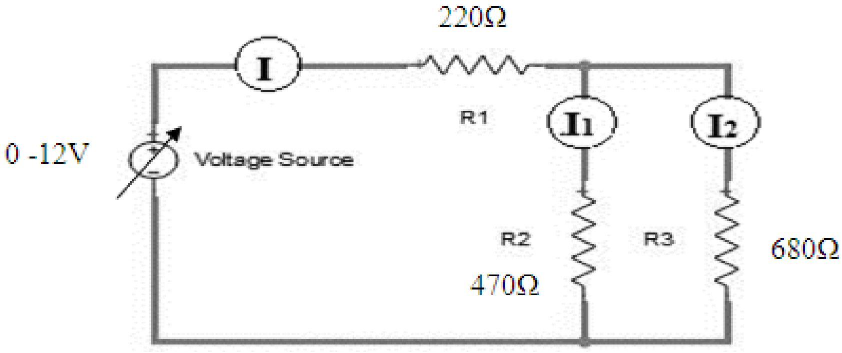
According-to this law, in any network of wires carrying currents, the algebraic sum of all the currents meeting at a node is zero or the sum of all the incoming currents is equal to the sum of outgoing currents away from that node.

Let I_1, I_2, I_3, I_4, I_5 I_6 be the currents at node O. I_1, I_4, I_5 are the currents entering the node O and I_2, I_3, I_6 are the currents leaving the node O. Then according to Kirchhoff's current law,

i.e $I_1+I_4+I_5=I_2+I_3+I_6$



CIRCUIT – KCL



PROCEDURE FOR KCL:

1. Give the connections as per the circuit diagram.
2. Set a particular voltage value in RPS.
3. Note down the corresponding ammeter reading
4. Repeat the same for different voltages

OBSERVATION:

Sl.No	Applied voltage				
	V in volts	I in (mAmps)	I_1in (mAmps)	I_2in (mAmps)	$I=I_1+I_2$ (mAmps)
1					
2					
3					

PRECAUTIONS:

1. Voltage control knob should be kept at minimum position.
2. Current control knob of RPS should be kept at maximum position.

RESULT:

DISCUSSION OF RESULT:

EXPERIMENT 1 (b)

VERIFICATION OF KVL

AIM: To verify Kirchhoff's voltage law for the given circuit

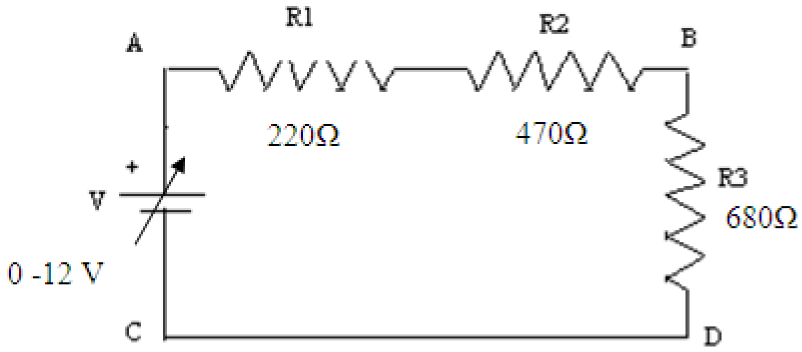
APPARATUS REQUIRED:

Sl.No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-12V)	1
2	Resistance	220Ω,470Ω,680Ω	3
3	Ammeter	(0-200mA)MC	3
4	Voltmeter	(0-30V)MC	3
5	Connecting wires	--	Required

THEORY:-

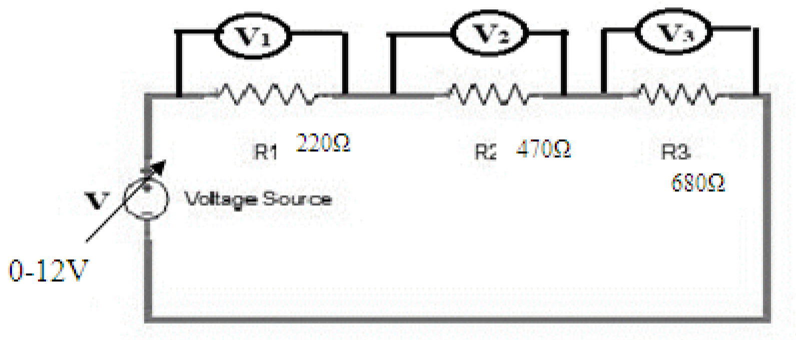
Kirchhoffs Voltage Law:

According to this law, in any closed circuit or mesh, the algebraic sum of EMFs acting in that circuit or mesh is equal to the voltage drops of each element of the circuit.



In mesh ABCD, $V=I(R_1+R_2+R_3)$

CIRCUIT – KVL



PROCEDURE FOR KVL:

1. Give the connections as per the circuit diagram.
2. Set a particular voltage value in RPS.
3. Note all the voltage reading
4. Repeat the same for different voltages

OBSERVATIONS:

Sl.No	Applied voltage				
	V in volts	V_1 in volts	V2 in volts	V3 in volts	V = VI+V2+V3
1					
2					
3					

RESULT:

DISCUSSION OF RESULT:

EXPERIMENT 1 (c)

VERIFICATION OF SUPERPOSITION THEOREM

AIM: To verify superposition theorem for the given circuit

APPARATUS REQUIRED:

Sl.No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-30V)	1
2	Resistance	220Ω,470Ω,680Ω	3
3	Ammeter	(0-200mA)MC	3
4	Voltmeter	(0-30V)MC	3
5	Connecting wires	--	Required

THEORY:

In a bilateral network consisting of a number of sources, the response in any branch is equal to sum of the responses due to individual sources taken one at a time with all other sources reduced to zero. When a network consists of several sources, this theorem helps us to find the current in any branch easily, considering only one source at a time.

CIRCUIT DIAGRAMS:

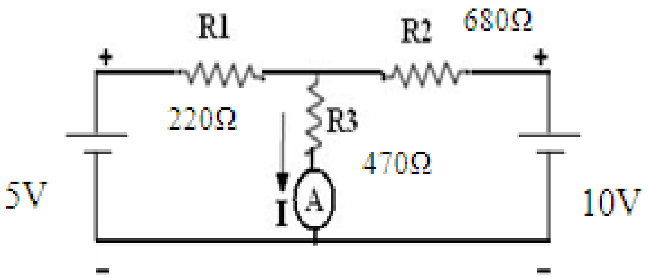


Fig 1.

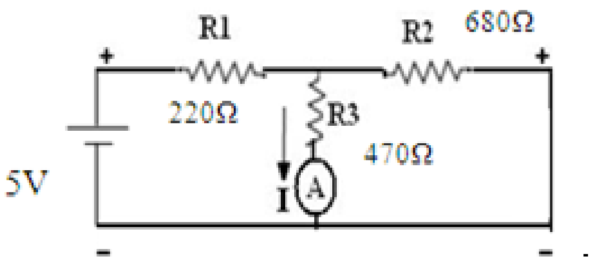


Fig.2

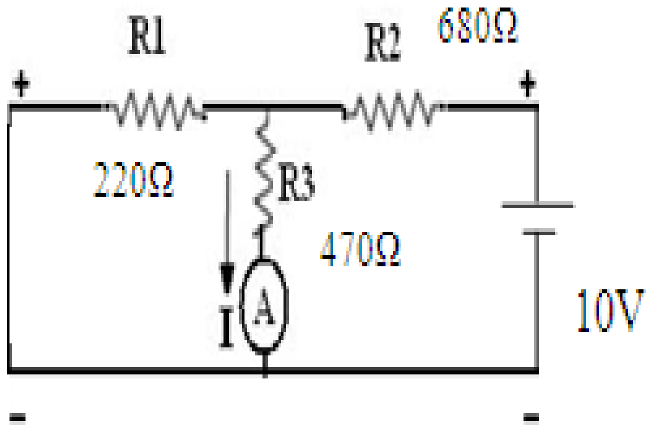


Fig 3.

PROCEDURE:

1. Connect the circuit as shown in fig.1.
2. Adjust the voltage of the source (1) to 5V and that of source (2) to 10V.Note the current (I) read by the ammeter.
3. Disconnect source (2) and short the terminals as in fig(2) with sourceVoltage (1) at 5V read the ammeter current (I_1).
4. Disconnect source and short the terminals as in fig(3).With source (2) voltage at 10V read the ammeter current (I_2).
5. Verify the equation $I = I_1 + I_2$.
6. Repeat steps 2 to 5 for different voltages.

OBSERVATIONS:

S.No	V_1	V_2	I(mA)	I_1 (mA)	I_2 (mA)	$I=I_1+I_2$ (mA)
1	5	10				
	5	--				
	--	10				

RESULT:

DISCUSSION OF RESULTS:

EXPERIMENT 2(a)

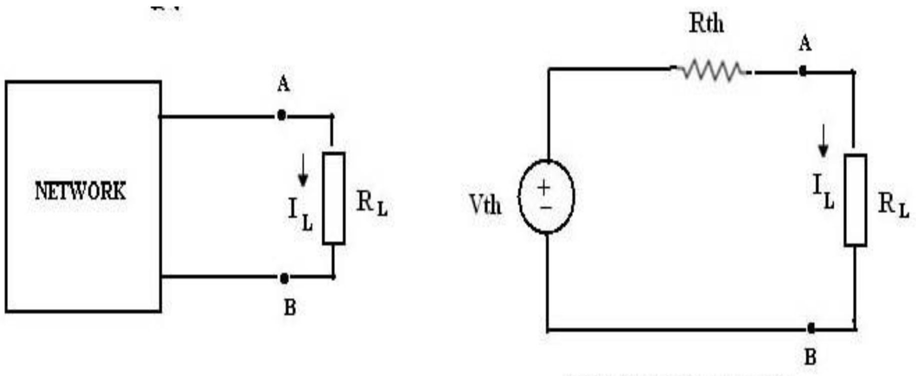
VERIFICATION OF THEVENINS THEOREM

AIM: To verify Thevenin's Theorem for the given circuit

APPARATUS:

Sl.No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-12V)	1
2	Resistance Network		1
3	Ammeter	(0-1A)	1
4	Voltmeter	(0-30V)	1
5	Connecting wires	--	Required

THEORY:



THEVENIN'S EQUIVALENT CIRCUIT

Any linear bilateral network with respect to two terminals (A and B) can be replaced by a single voltage source V_{th} in series with a single resistance R_{th}. Where, V_{th} is the open circuit voltage across the load terminals and R_{th} is the internal resistance of the network as viewed back into the open circuited network from the terminals A and B with voltage sources and current sources replaced by their internal resistances. Then the current in the load resistance is given by,

$$I_L = V_{th} / (R_{th} + R_L)$$

CIRCUIT DIAGRAMS:

To find Thevenin's Voltage:

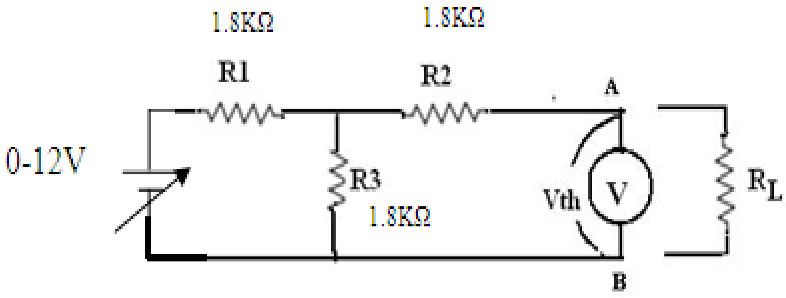


Fig. 1

To find Thevenin's resistance :

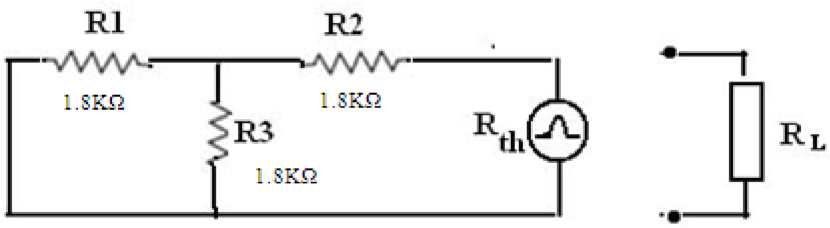


Fig 2.

To find load current :

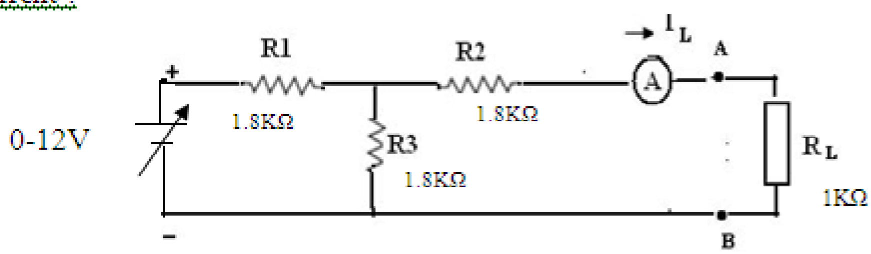


Fig-3

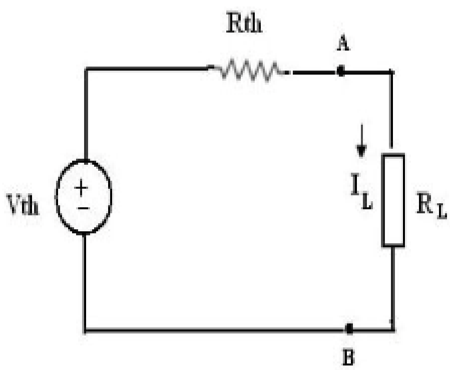


Fig. 4 Thevenin's Equivalent circuit

PROCEDURE:

1. Connect the circuit as shown in fig.1 and apply suitable voltage. Note down the open circuit voltage (V_{th}).
2. Connect the circuit as shown in fig.2 and note the Thevenin's resistance R_{th} by means of a multimeter.
3. Connect the circuit as shown in fig.3.For a particular value of load resistance R_L, keeping the voltage of RPS at the same value as in step1, note the value of the current. Verify the current value obtained by applying the Thevenin's theorem i.e I_L should be equal to V_{th} / $(R_{th}+R_L)$.
4. Repeat step3 for various values of load resistances and compare with the calculated values, as obtained by applying Thevenin's theorem.
5. Vary the input voltage and take three sets of readings (step 2 need not be repeated as long as the network is not changed).

OBSERVATIONS:

R_{th}=

S.No.	V_s	V_{th}	R_L(KΩ)	I_L(Measured Value) (mAmp)	I_L(By applying theorem) $I_L=V_{th}/(R_{th}+R_L)$ (mAmp)

RESULT:

DISCUSSION OF RESULT:

<u>EXPERIMENT 2(b)</u>

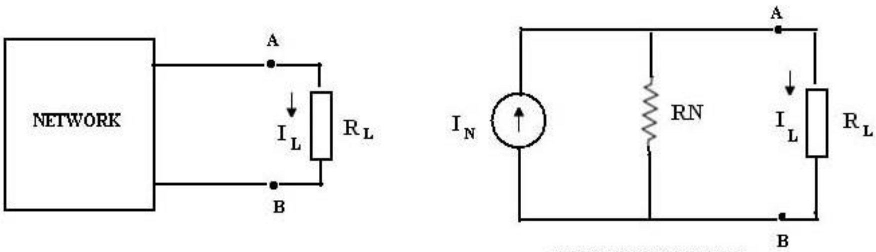
VERIFICATION OF NORTON'S THEOREM

AIM: To verify Norton's Theorem for the given circuit

APPARATUS:

Sl.No.	Apparatus	Range	Quantity
1	RPS (regulated power supply)	(0-30V)	1
2	Resistance Network		1
3	Ammeter	(0-1A)	1
4	Voltmeter	(0-30V)	1
5	Decade Resistance Box		1
6	Connecting wires	--	Required

THEORY:



NORTON'S EQUIVALET CIRCUIT

Any linear bilateral network with respect to a pair of terminals (A and B) can be replaced by a single current source I_N in parallel with a single resistance R_N. Where, I_N is the short circuit current in between the load terminals and $R_N(=R_{th})$ is the internal resistance of the network as viewed back into the open circuited network from the terminals A and B with voltage sources and current sources replaced by their internal resistances. Then the current in the load resistance is given by,

$$I_L = I_N R_N / (R_N + R_L)$$

CIRCUIT DIAGRAMS:

<u>To find short circuit current:</u>

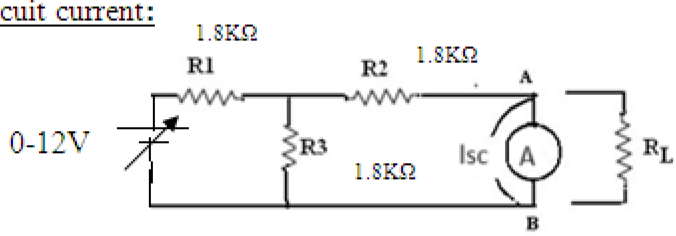


Fig 1

To find Norton's resistance :

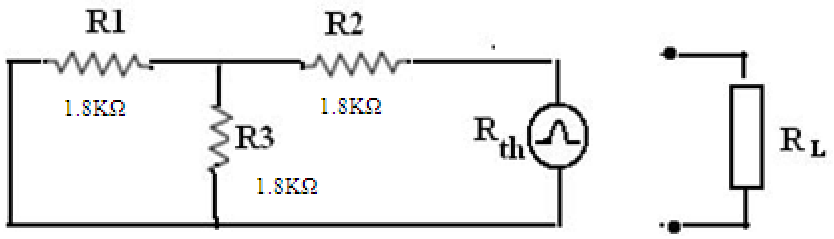


Fig 2

To find load current:

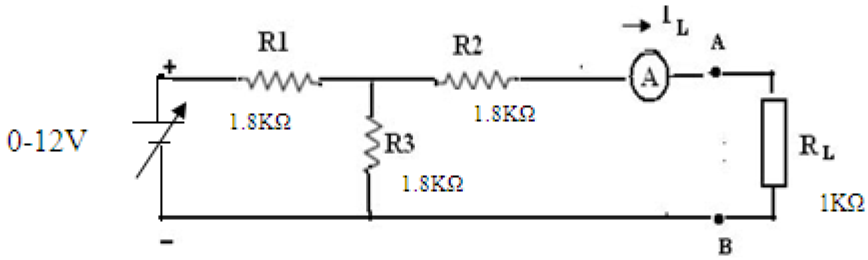


Fig 3

PROCEDURE:

1. Connect the circuit as shown in fig.1 and by applying suitable voltage through RPS, determine the short circuit current (I_N / I_{sc}.).
2. Connect the circuit as shown in fig.2 and note the Norton's resistance R_N by means of a multimeter.
3. Note down the load currents for various values of load resistance (R_L) and compare with the theoretical values obtained using Norton's equivalent circuit.
4. Repeat steps 1 &3 for various values of source voltages.

OBSERVATIONS:

R_N =

S.No.	V_s	I_N /I_{sc} (mA)	R_L(KΩ)	I_L(Measured Value) (mA)	I_L(By applying theorem) $I_L=I_N R_N/(R_N + R_L)$ (mA)

RESULT:

DISCUSSION OF RESULT:

EXPERIMENT 3 (a)

SINUSOIDAL STEADY STATE RESPONSE OF R-L CIRCUIT.

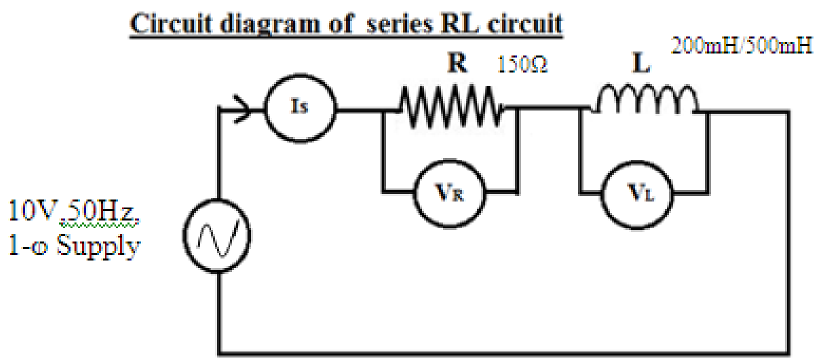
AIM: To verify voltage, current, power factor and impedance variations of R-L circuit to a sinusoidal input at steady state condition .

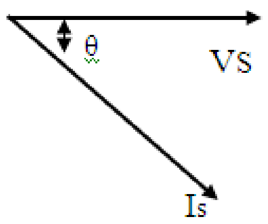
APPARATUS REQUIRED:

S.No	Name of Apparatus	Range/Rating	Required
1	Function Generator	0-10MHz	1
2	Voltmeter	0-5V	2
3	Ammeter	0-20mA	1
4	Resistance - DRB		1
5	Inductance - DIB		1
6	Capacitance- DCB		1
7	Connecting Wires		APR

THEORY:-

Any circuit behavior depends on the parameters of the elements available in it. Such elements, which drastically changes the parameters of the circuit, are resistance, inductance and capacitance. In series RL network when a voltage V_s is applied then the current I_s flows into the circuit which creates a voltage drops across resistance V_R and inductance V_L and these voltages lag by an angle θ as well the current I_s lags the applied voltage V_s and this angle is 90 for pure inductor.





PROCEDURE:

1. Connect circuit as shown in the circuit diagram
2. Apply the voltage using Function Generator and set the frequency to 50Hz
3. Note all the readings and tabulate them in the given tabular form.
4. Repeat the procedure with different R&L values

OBSERVATIONS:

Practical values

R in ohms	L in mH	V_s	I_s (mA)	V_R	V_L	$\|Z\| = \frac{V_s}{I_s}$ (Ω)	$\theta = tan^{-1} (\frac{V_L}{V_R})$	Cos θ
150	200							
150	500							

Theoretical values:

R in ohms	L in mH	V_s	I_s (mA)	V_R	V_L	$\|Z\| = \frac{V_s}{I_s}$ (Ω)	$\theta = tan^{-1} (\frac{V_L}{V_R})$	Cos θ
150	200							

RESULT:

DISCUSSION OF RESULT:

EXPERIMENT 3 (b)

SINUSOIDAL STEADY STATE RESPONSE OF R-C CIRCUIT.

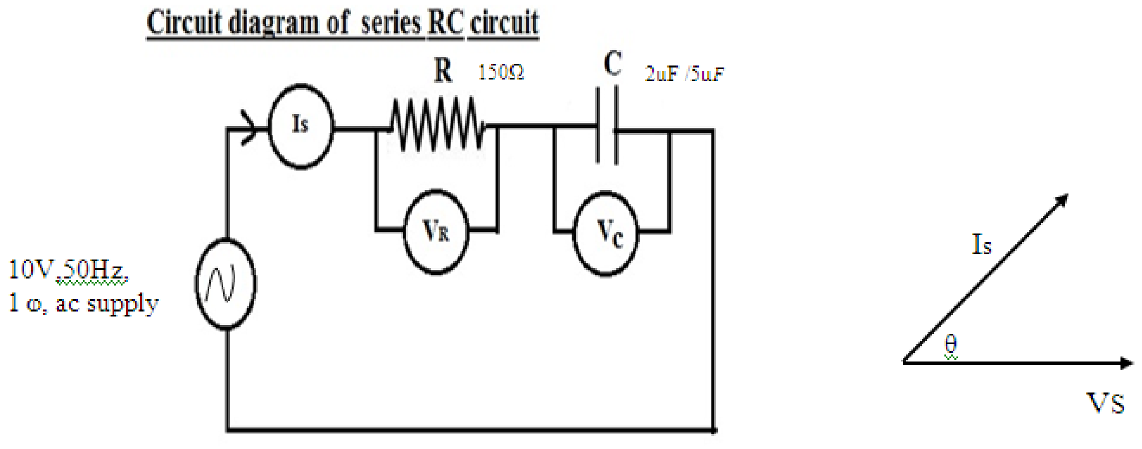
AIM: To verify voltage, current, power factor and impedance variations of R-C circuit to a sinusoidal input at steady state condition.

APPARATUS REQUIRED:

S.No	Name of Apparatus	Range/Rating	Required
1	Function Generator	0-10MHz	1
2	Voltmeter	0-5V	2
3	Ammeter	0-20mA	1
4	Resistance - DRB		1
5	Inductance - DIB		1
6	Capacitance- DCB		1
7	Connecting Wires		APR

THEORY:-

Any circuit behavior depends on the parameters of the elements available in it. Such elements, which drastically changes the parameters of the circuit, are resistance, inductance and capacitance In series RC network when a voltage V_s is applied then the current I_s flows into the circuit which creates a voltage drops across resistance V_R and capacitance V_c and these voltages lead by an angle θ as well the current I_s lead the applied voltage V_s and this angle is 90 for pure capacitor



PROCEDURE:

1. Connect circuit as shown in the circuit diagram
2. Apply the voltage using Function Generator and set the frequency to 50Hz
3. Note all the readings and tabulate them in the given tabular form.
4. Repeat the procedure with different R&C values

OBSERVATIONS:

Practical values

R in ohms	C in µF	V_s	I_s (mA)	V_R	V_C	$\lvert Z\rvert = \frac{V_s}{I_s}$ (Ω)	$\theta = tan^{-1}\left(\frac{-V_c}{V_R}\right)$	Cos θ
150	2							
150	5							

Theoretical values:

R in ohms	C in µF	V_s	I_s (mA)	V_R	V_c	$\lvert Z\rvert = \frac{V_s}{I_s}$ (Ω)	$\theta = tan^{-1}\left(\frac{-V_c}{V_R}\right)$	Cos θ
150	2							

RESULT:

DISCUSSION OF RESULT:

EXPERIMENT 4 (a)

MEASUREMENT OF PHASE VOLTAGE/CURRENT LINE VOLTAGE/CURRENT AND POWER IN BALANCED THREE-PHASE CIRCUIT IN STAR CONNECTION.

AIM: To study the balanced three phase system for star connected load.

APPARATUS REQUIRED:

S.No	Name of Apparatus	Range/Rating	Required
1	Three phase Variac	440/0-440V	1
2	Ammeter (AC)	10A	1
3	Voltmeter (AC)	600V	1
4	Rheostats	25ohms/5A	3
5	Wattmeter Meter	0-300V/5A UPF	1
6	Connecting wires	As per requirement	

THEORY: - Star Connection→ In this connection, the starting or termination ends of all winding are connected together & along with their phase ends this common point is also brought out called as neutral point.

Some term related to 3 phase system

i. **Line Voltage -** The voltage between any two line of 3 ph load is called as line voltage e.g. V_{RY}, V_{YB}& V_{BR}. For balance system all are equal in magnitude.

ii. **Line Current**– The current in each line is called as line current e.g. I_R, I_Y, & I_B. They are equal in magnitude for balance system.

iii. **Phase Voltage**– The voltage across any branch of three phase load is called as phase voltage. **V_{RN}, V_{YN}, & V_{BN}** are phase voltage

iv. **Phase Current**– current passing through any phase of load is called as phase current.

For star connection of load-

Line voltage (V_L) = √3 phase voltage (V_{ph})

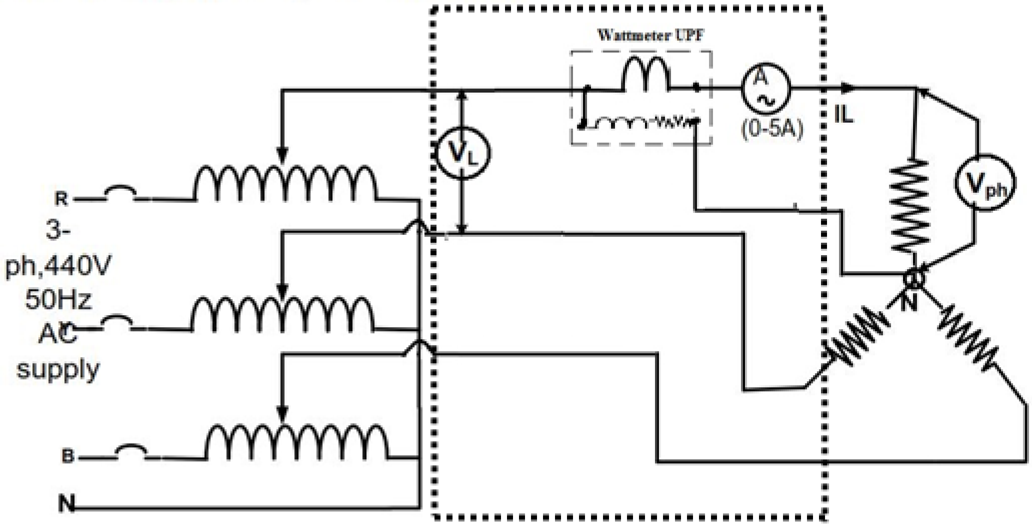
Line current (I_L) = Phase current (I_{ph})

Three phase power is given by,

P= power consumed by the load = $\sqrt{3} V_L I_L \cos(\theta)$

Where θ is phase angle & it depends on type of load i.e. inductive, capacitive or resistive.

Circuit Diagram: A) For star connected load:



Multi Function Meter

PROCEDURE:

1. Connect circuit as shown in the circuit diagram
2. Set 3-ph Variac to minimum position.
3. Switch on the main supply
4. Apply a voltage by using 3-ph Variac
5. Note the readings of ammeter, voltmeter & wattmeter meter.
6. Repeat the above procedure by changing supply voltage.

OBSERVATIONS:

S.No	Line Voltage(V_L)	Phase Voltage(V_{Ph})	Line Current(I_L)	Phase Current(I_{Ph})	Power $W=\sqrt{3}\ V_L I_L \cos Ø$

RESULT:

DISCUSSION OF RESULT:

EXPERIMENT 4 (b)

MEASUREMENT OF PHASE VOLTAGE/CURRENT LINE VOLTAGE/CURRENT AND POWER IN BALANCED THREE-PHASE CIRCUIT IN DELTACONNECTION.

AIM : To study the balanced three phase system for delta connected load.

APPARATUS REQUIRED:

S.No	Name of Apparatus	Range/Rating	Required
1	Three phase Variac	440/0-440V	1
2	Ammeter (AC)	10A	1
3	Voltmeter (AC)	600V	1
4	Rheostats	25ohms/5A	3
5	Wattmeter Meter	0-300V/5A UPF	1
6	Connecting wires	As per requirement	

THEORY:-

Delta Connection- If the terminating end of one winding is connected to starting end of other & If connection is continued for all their windings in this fashion we get closed loop. The three supply lines are taken out from three junctions. This is called as three phase delta connected system.

Some term related to 3 phase system

i. **Line Voltage -** The voltage between any two line of 3 ph load is called as line voltage e.g. V_{RY}, V_{YB}& V_{BR}. For balance system all are equal in magnitude.

ii. **Line Current**– The current in each line is called as line current e.g. I_R, I_Y, & I_B. They are equal in magnitude for balance system.

iii. **Phase Voltage**– The voltage across any branch of three phase load is called as phase voltage. **V_{RN}, V_{YN}, & V_{BN}** are phase voltage

iv. **Phase Current**– current passing through any phase of load is called as phase current.

F**or delta connection of load-**

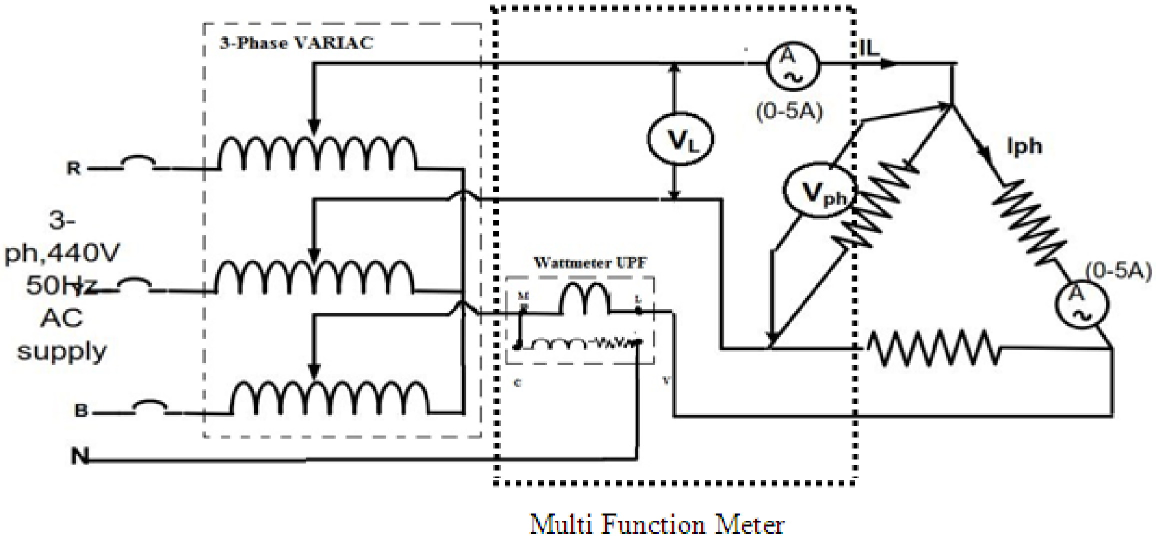
Line voltage (VL)= phase voltage (Vph)
Line current (IL)= √3 phase current(Iph)

Three phase power is given by,

P= power consumed by the load = $\sqrt{3} V_L I_L \cos(\theta)$

Where θ is phase angle & it depends on type of load i.e. inductive, capacitive or resistive.

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connect circuit as shown in the circuit diagram
2. Set 3-ph Variac to minimum position.
3. Switch on the main supply
4. Apply a voltage by using 3-ph Variac
5. Note the readings of ammeter, voltmeter & wattmeter meter.
6. Repeat the above procedure by changing supply voltage.

OBSERVATIONS:

S.No	Line Voltage(V_L)	Phase Voltage(V_{Ph})	Line Current(I_L)	Phase Current(I_{Ph})	Power $W=\sqrt{3}\ V_L I_L$ CosØ

RESULT:

DISCUSSION OF RESULT:

EXPERIMENT 5

LOADING OF SINGLE PHASE TRANSFORMER

AIM: To measure the primary and secondary current, voltage and power of the given transformer.

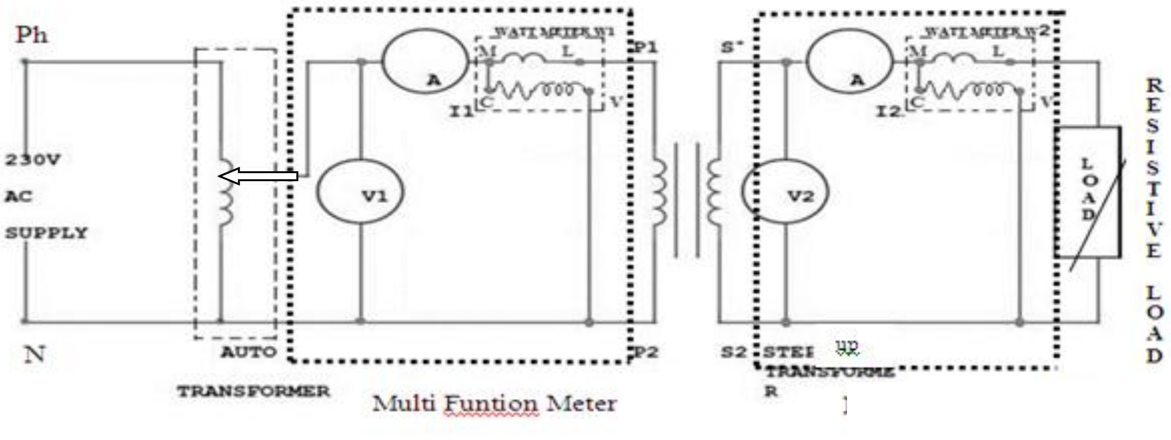
APPARATUS:

Sl.No.	Apparatus	Range	Quantity
1	Single phase Transformer	110/230V	1
2	Auto transformer	230/(0–270) V	1
3	Ammeter(MI)	(0-10/20A)	2
4	Voltmeter(MI)	(0-150/300V)	2
5	Resistive Load Box	0-10KW	1
6	Wattmeter	(0-300V/20A) UPF	2
7	Connecting wires	--	Required

THEORY:

Transformer works on the principal of mutual induction, which implies-when the ac voltage applied to the primary coil, then the ac current flows in the primary coil gives rise to flux change. The change of flux induces emf in the secondary coil due to mutual induction. We will measure the voltage, current and power by using voltmeter and ammeter.

CIRCUIT DIAGRAM



PROCEDURE:

1. Connect the circuit as shown in figure above

2.Apply the rated voltage by using auto transformer

3. Take the readings of I_1, V_1 and W1 from primary side

4. Take the readings of I_2, V_2 and W2 from secondary side

5. Apply the load in steps by using resistive load box

6. Tabulate the readings for every change in load

OBSERVATIONS:

S.No.	V_1 Primary Voltage	I_1 Primary Current	W_1 Primary power	V_2 Secondary voltage	I_2 Secondary curren	W_2 Secondary power

RESULT:

DISCUSSION OF RESULT

EXPT 6: POWER FACTOR IMPROVEMENT OF INDUCTION MOTOR USING STATIC CAPACITORS

AIM: To verify Power factor improvement of Induction Motor using static capacitors

Apparatus:

Sno	Description	Range	Type	Quantity
1	1 Phase Induction Motor	1Hp		1
2	1phase multi-function meter	0-10A/20A, 0-300V	MI	1
3				
4				
5	Connecting wires			As per Requirement
6	Capacitor Bank	8.5 µF and 17µF		2

Theory:

Low power factor is undesirable from economic point of view. Normally, the power factor of the whole load on the supply system in lower than 0·8. The following are the causes of low power factor:

(i) Most of the a.c. motors are of induction type (1-φ and 3-φ induction motors) which have low lagging power factor.

(ii) Arc & electric discharge lamps &industrial heating furnaces operate at low lagging PF.

(iii) The load on the power system is varying; being high during morning and evening and low at other times. During low load period, supply voltage is increased which increases demagnetization current. This results in the decreased power factor.

Static capacitor. The power factor can be improved by connecting capacitors in parallel with the equipment operating at lagging power factor. The capacitor (generally known as static) draws a leading current and partly or completely neutralizes the lagging reactive component of load current. This raises the power factor of the load. For three-phase loads, the capacitors can be connected in delta or star as shown in Fig. 6.4. Static capacitors are invariably used for power factor improvement in factories.

Advantages

(i) They have low losses. (ii) They require little maintenance, as there are no rotating parts.

(iii) They can be easily installed as they are light and require no foundation.

(iv) They can work under ordinary atmospheric conditions.

Procedure:

1. Connections are made as per circuit diagram
2. Keep the DOL starter in off position and capacitor bank switch in Zero position & switch on the supply by closing the DPST switch.
3. Push Green button of DOL starter & Take down all the meter readings
4. Switch the capacitor bank switch to position ‘1’ and note down all the meter readings
5. Switch the capacitor bank switch to position ‘2’ and note down all the meter readings
6. Bring back the capacitor bank switch to position 0 and switch the motor by pushing red button on DOL starter and remove the connections

Tabular Column

Sno	**Capacitor Value**	**Voltage V**	**Current I**	**Power W**	**I_c**	$X_c = V/ I_c$	**Calculated Capacitor value**
1	No capacitor		I_0 =		------	-----	----
2			I_{f1}=		I_{c1}=		
3			I_{f2}=		I_{c2}=		

Theoretical Calculations

$I_{c1} = I_0 - I_{f1} =$

$I_{c2} = I_0 - I_{f2} =$

$X_{c1} = \frac{V}{I_{c1}} =$

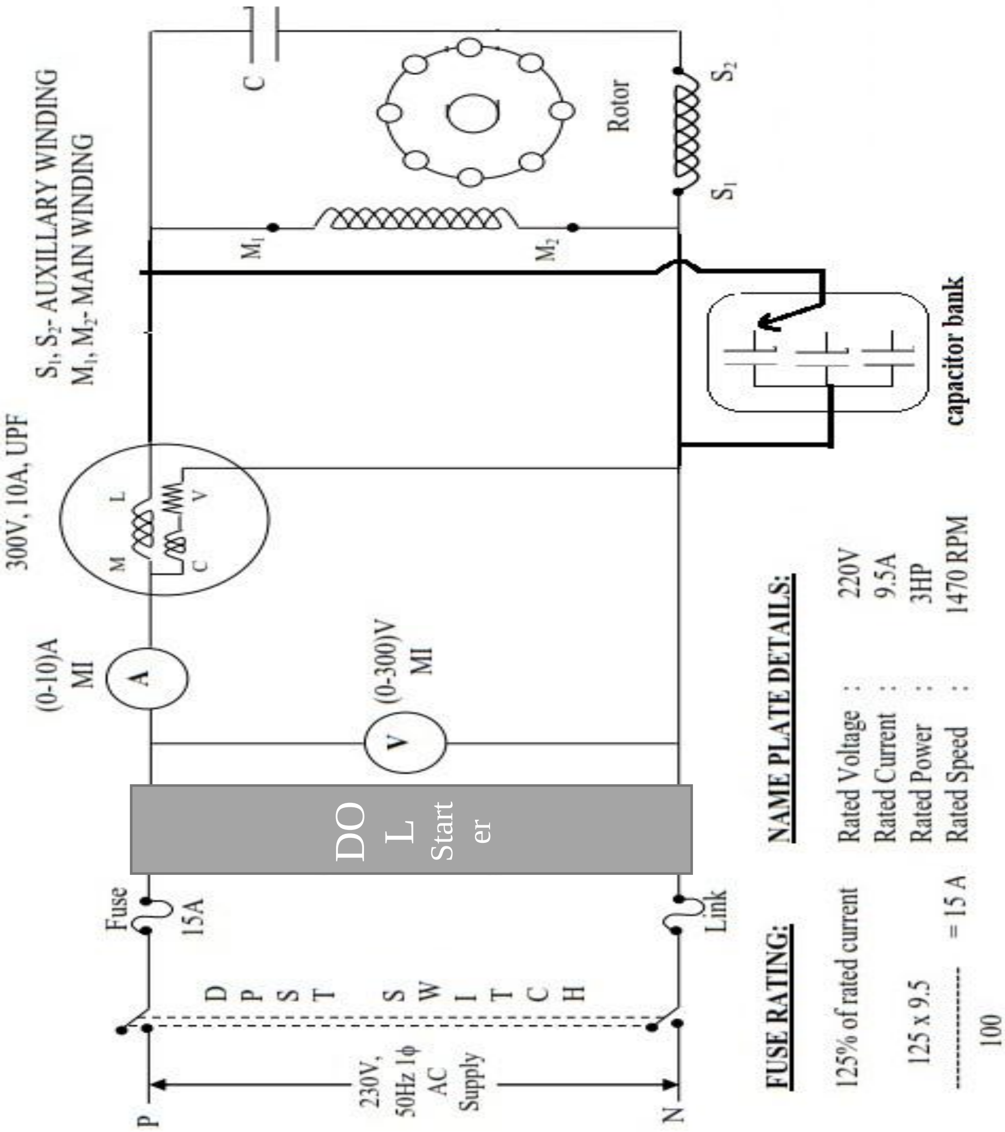
$X_{c2} = \frac{V}{I_{c2}} =$

$C_1 = \frac{1}{2\pi f X_{c1}} =$

$C_1 = \frac{1}{2\pi f X_{c2}} =$

where f is the frequency = 50Hz

C = capacitor in micro farads



RESULT:

DISCUSSION OF RESULT:

EXPT 7: SYNCHRONOUS SPEED OF TWO AND FOUR-POLE, 3-ϕ INDUCTION MOTORS. DIRECTION REVERSAL BY CHANGE OF PHASE-SEQUENCE OF CONNECTIONS

AIM: To verify the speed of 3Φ Induction motor for a a) 2 pole Configuration circuit

b) 4pole Configuration circuit &To change the direction of a three phase induction motor rotation.

NAME PLATE DETAILS:

Induction Motor

Voltage-------------- Current ----------------

Power--------------- Speed-------------------

APPARATUS REQUIRED:

SL.NO	NAME OF EQUIPMENT	TYPE	RANGE	QUANTITY
1	Voltmeter	MI	0-600V	1
2	Rheostat	Wire wound	25Ω	3
3	Tachometer	Digital	0-99999	1
4	3Φvariac		(0-470V)	1

Theory

The speed with which Stator field revolves is the synchronous speed. It is the speed at which the rotating magnetic field (rmf) rotates. if a three phase induction motor is having 6 poles with 50hz supply frequency then the synchronous speed will be(Ns=120f/p) 1000rpm.Simillarly 4 pole machines must work on 1500RPMN whereas 2 Pole machine at 3000RPM.

In order for an induction motor to make **torque**, there must be at least some difference between the stator field (synchronous) speed and the rotor speed. That difference is called “slip.” It is why, when you look at a motor nameplate, the motor rated speed will always be less than synchronous speed. The direction of rotation of a 3 phase induction motor can be reversed by interchanging any two of the three motor supply lines.

Let the phase sequence of the three-phase voltage applied to the stator winding is R-Y-B. If this sequence is changed to R-B-Y, it is observed that direction of rotation of the field is reversed i.e., the field rotates counterclockwise rather than clockwise. However, the number of poles and the speed at which the magnetic field rotates remain unchanged.Thus it is necessary only to change the phase sequence in order to change the direction of rotation of the magnetic field. For a three-phase supply, this can be done by interchanging any two of the three lines

CIRCUIT DIAGRAM:

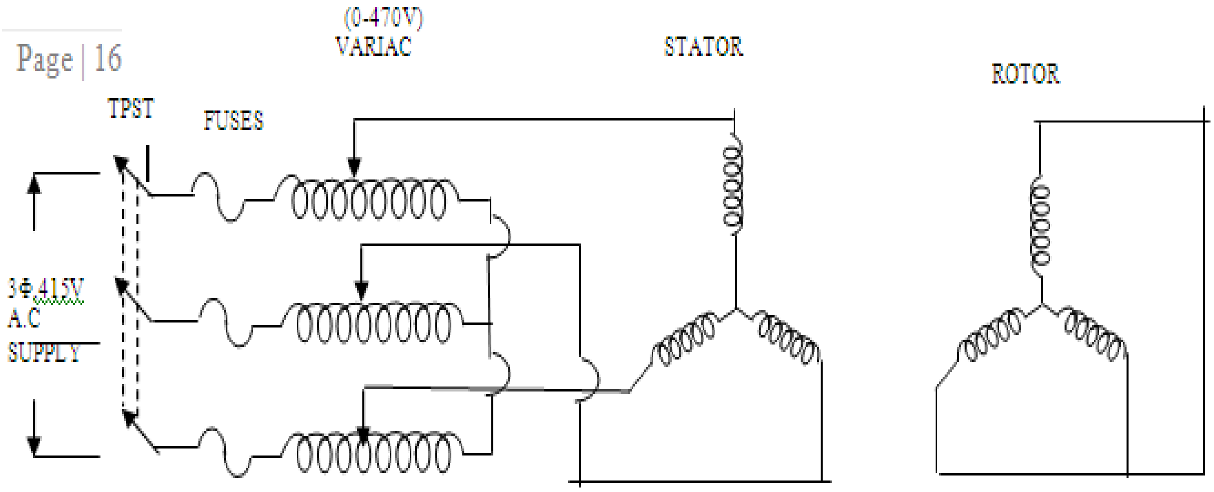


Figure 2 CIRCUIT DIAGRAM FOR INDEPENDENT MOTOR WITH EITHER 4 POLES/2 POLES

PROCEDURE FOR POLE CHANGE

1) Make the connections as per the circuit diagram
2) Switch on the supply and apply the rated voltage to motor by using 3 phase Variac
3) With the help of tachometer note the values of speed with different pole configuration
4) Bring back the Variac to initial zero position and switch of the supply
5) Calculate the slip by using given formulas

OBSERVATIONS:

S.NO	Poles	Synchronous Speed $N_s = \frac{120f}{P}$ r.p.m	Rotor Speed (Nr) r.p.m	%S = $\frac{Ns - Nr}{Ns}$ *100
1	2			
2	4			

PROCEDURE FOR DIRECTION REVERING

1. Make the connections as per the circuit diagram

2. Switch on the supply and apply the rated voltage to motor by using 3 phase Variac

3.Speed of the motor is measured by a speedometer.

4. Now the motor is stopped by pushing the stop button and supply to the motor is removed by opening the TPST switch.

5. Interchange the phase sequence.

6. Close the TPST switch on the supply and start the motor.

7. The direction of rotation of the motor is observed. Speed of motor is again measured by a speedometer.

8. Push the stop push button and turn of the Motor and remove the connection.

RESULT

DISCUSSION OF RESULT

EXPT 8: MAGNETISATION CURVE OF A SEPARATELY EXCITED D.C GENERATOR

AIM: To obtain the magnetization characteristics (O. C. C) of a D .C. separately excited generator.

EQUIPMENTS REQUIRED:

SL.NO	NAME OF EUIPMENT	TYPE	RANGE	QUANTITY
1	Ammeter	M.C	0-1A	1
2	Voltmeter	M.C	0-300V	1
3	Rheostat	Wire wound	1000Ω/1A	1

NAME PLATE DETAILS:

D.C. Compound Motor

Voltage-------------- Current ----------------

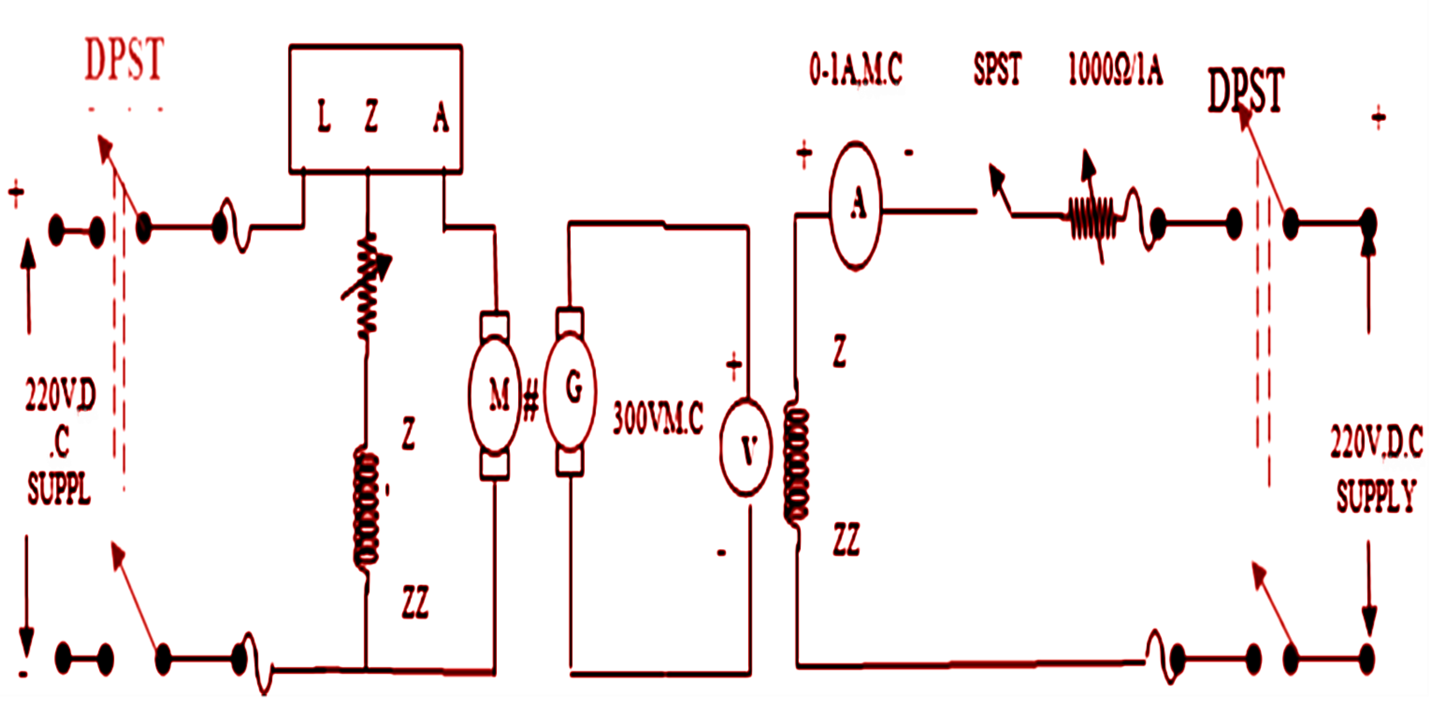
Power--------------- Speed-------------------

THEORY

An Electric generator consists of a rotor spinning in a magnetic field. The magnetic field may be produced by permanent magnets or by field coils. In the case of a machine with field coils, a current must flow in the coils to generate the field, otherwise no power is transferred to or from the rotor. The process of generating a magnetic field by means of an electric current is called ***excitation***.

The **critical field resistance** is the maximum field circuit resistance for a given speed with which the shunt generator would excite. The shunt generator will build up voltage only if field circuit resistance is less than critical field resistance. It is a tangent to the open circuit characteristics of the generator at a given speed.

CIRCUIT DIAGRAM:



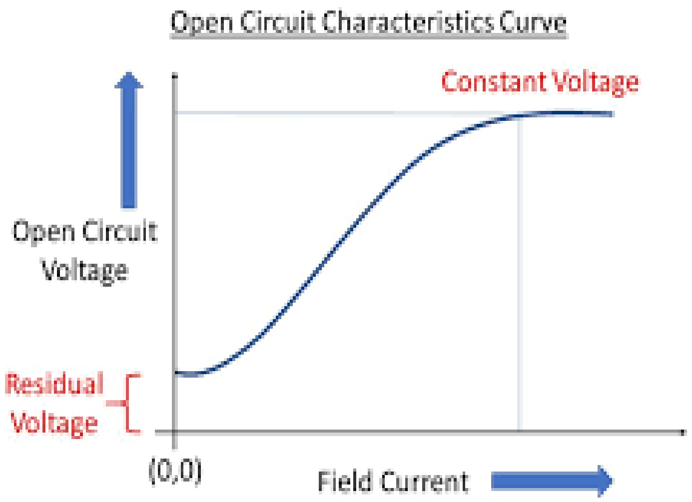
PROCEDURE:

1. Make the connections as per the diagram, choosing the meters suitable to the ratings of the machines.
2. Keep the motor field rheostat in the minimum position that of the generator field rheostat in the maximum position and start the motor by means of a starter.
3. Run the set at rated speed.
4. Note down the terminal voltage of the M-G set with switch S_1 open. This e.m.f is due to the residual magnetism.
5. Close the switch S_1, note down the field current of the generator and e. m. f induced by the generator.
6. Increase the field current of the generator in steps by cutting out the resistance of the field rheostat.
7. Note down the corresponding value of EMF induced by the generator.
8. The resistance should be changed in one direction.
9. The same procedure should be repeated with decreasing values of field current. Finally, open SI switch and note down the value of e.m.f generated by residual magnetism.
10. Draw the graph for the EMF generated Vs field current (both increasing and decreasing values

OBSERVATIONS:

S.NO	I_F	E_O(INCREASING)	E_O(DECREASING)	Average

EXPECTED GRAPH:



RESULTS:

DISCUSSION OF RESULTS: