Rajiv Gandhi University of Knowledge Technologies

Department of Electrical Engineering

BASICS OF ELECTRICAL ENGINEERING LAB

List of experiments:

Sl. No	Name of the experiment	Cycle no
1).	Verification of KCL and KVL in electric circuits	1
2).	Calibration of single phase energy meter	
3).	Verification of Network theorems (Superposition &Thevenin's theorems)	2
4).	Study of series RLC circuit	
5).	Characteristics of lamps	
6).	Magnetization characteristics of DC generator	3
7).	Three phase power measurement	
8).	O.C &S.C tests on single phase transformer	
9).	Speed control of DC shunt motor (optional)	

Schedule of Lab conduction:

1st and 2nd week	Familiarization of electrical equipments
3,4,5th weeks	cycle1 (three experiments to be performed parallel)
6,7 and 8th week	cycle2 (three experiments to be performed parallel)
9,10 and 11th Week	cycle3 (three experiments to be performed parallel)
12th week	Revision(optional)
13 th week	End sem examination

Instruction to Students:

1. Students must come with proper dress code
2. No students are allowed to perform the experiments without prior preparation of theory (self preparation), observation note book and Lab record.
3. The circuit diagrams must be drawn with pencil by using scale only (No free hand diagrams are permitted) and it must be checked for all ratings whether it is proper or not.
4. Once students doesn't satisfy the above 3 points they will not be permitted to perform the experiments further they are not allowed to take any extra lab to complete that session.
5. Students must refer the Videos and reading material which is available in content of ET course for respective topics and clarify the doubts with concerned Lab faculty prior to their experiments.

BASIC ELECTRICAL ENGINEERING LABORATORY SAFETY RULES

1. Do not touch any terminals (or) Switch without ensuring that it is dead.
2. Wearing shoes with rubber sole is desirable.
3. Use a fuse wire of proper rating.
4. Use sufficient long connecting leads rather than joining two or there small ones, because in case any joint is open it could be dangerous.
5. Make sure that all the electrical connections are correct before switching on any circuit. Wrong connections may cause large amount of current which results damage of equipment.
6. The circuit should be de-energized while changing any connection.
7. In case of emergency or fire switch-off the master switch on the main panel board.
8. Keep away from all the moving parts as for as possible.
9. Do not renew a blown fuse until you are satisfied to the cause and rectified problem.
10. Do not touch an electric circuit when your hands are wet or bleeding from a cut.
11. Do not disconnect plug by pulling a flexing cable when the switch is on.
12. Do not throw water on live electrical equipment in case of fire.
13. Do not test the circuit with bear fingers.
14. Do not use loose garments while working in Laboratory.
15. Avoid loose connections. Loose connections leads to heavy sparking & damage for the equipments as well as danger for the human life.

Experiment No: 01

VERIFICATION OF KIRCHOFF'S LAWS

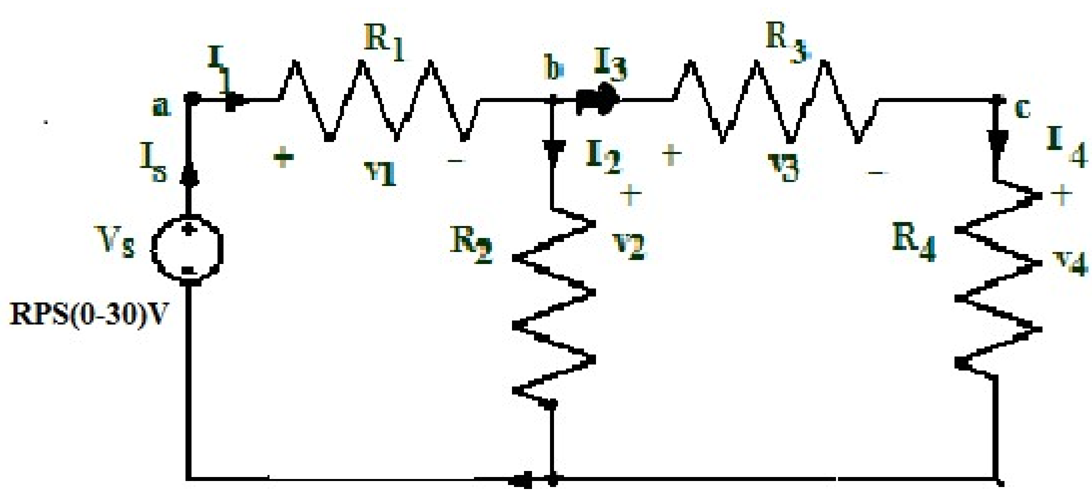
Aim:

To understand the terms related to basic network topology and to verify Kirchoff's voltage law and current law for the electric circuits.

Apparatus:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Resistors	470Ω 470Ω 1k Ω 1k Ω		1 1 1 1
2	Bread board	-	-	1
3	Regulated power supply	0-30V	-	1
4	Multimeter	-	Digital	1
5	Single Stand Wires			As Required

Circuit diagram:



Theory:

Network Topology:
Studies the properties relating to the placement of elements in the network and the geometric configuration of the network. Such elements include branches, nodes and loops

Branch:
A branch represents a single element such as a voltage source or a resistor.

Node:
A node is the point of connection between two or more branches.

Loop:
A loop is any closed path in a circuit.

Mesh:
A Mesh is a loop which doesn't contain any closed loop within it.

Basic Connections:
Two elements are in **series** if they share one common node and no other element is connected to that common node.

Elements in **parallel** are connected to the same pair of terminals.
Elements may be connected in a way that they are neither in series nor in parallel.

Kirchoff's Laws:
Kirchhoff's voltage law (**KVL**) states that the algebraic sum of all voltagesaround a closed path (loop/Mesh) is zero.

Kirchhoff's current law (**KCL**) states that the algebraic sum of currents entering a node is zero.

Circuit Observations:

Number of branches …………………………………………..

Number of Nodes ……………………………………………..

Number of simple nodes ……………………………………..

Number of principle nodes……………………………………

Number of Loops……………………………………………..

Number of Meshes……………………………………………

Path of identified loops……………………………………....

Path of series branches……………………………………….

Experimental procedure:

Verification of KCL&KVL:

1. Using bread board construct the circuit shown in Figure 1.
2. Set the regulated power supply (V_s) to 10 Volts.
3. Accurately measure all the voltages and currents in the circuit using the digital Multi-Meter.
4. Record the measurements in a tabular column containing the measured voltage and current values as shown below.
5. Verify KVL for the loops in the circuit using equations 1a and 1b.
6. Verify KCL for the nodes in the circuit using equations 2a, 2b, 2c and 2d.
7. Repeat the same for Vs=20V
8. Also measure the actual resistances using multimeter and tabulate them.

Observation Table: $V_{S=}10v$

Branch Voltage/Current	V(volt)	I(mA)	R(Ω)	
			Nominal	Measured
V_1, I_1	4.44	9.40	470	472.340
V_2 , I_2	5.50	5.60	1k	982.142
V_3 , I_3	1.79	3.79	470	472.29
V_4 , I_4	3.76	3.78	1k	994.708

Loop equations to verify KVL:

Mesh 1: $-V_s + V_1 + V_2 - V_5 = 0$………………………………………………… (1a)
Mesh 2: $-V_2 + V_3 + V_4 = 0$…………………………………………………… (1b)
Loop 3: $-V_s+V_1+V_3+V_4-V_5=0$………………………………………………….. (1c)

Node equations to verify KCL:

Node a: $I_s - I_1 = 0$……………………………………………………………… (2a)
Node b: $I_1 - I_2 + I_3 = 0$…………………………………………………….... (2b)
Node c: $-I_3 - I_4 = 0$………………………………………………………….. (2c)
Node d: $I_2 + I_4 - I_5 = 0$…………………………………………………...... (2d)

Result: The study of KCL and KVL for a given network is verified.

Discussion questions:

1. A circuit has three nodes and three independent loops. Determine the number branches in the given circuit?
2. Can KVL and KCL be applicable for non linear, time varying circuits?
3. Is it possible to connect two ideal current sources of different magnitudes in series?
4. Is it possible to connect two ideal voltage sources of different magnitudes in series?
5. Why an ideal current source cannot be open circuited?

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Experiment No: 02

Single Phase Energy Meter

AIM:

To study the connections of an energy meter.

To use it to measure Electrical energy and also to calibrate the given energy meter.

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Autotransformer	0-230V		1
2	Ammeter	0-10A	MI	1
3	Voltmeter	0-300v	MI	1
4	Resistive Load	10 amps	1-Φ	1
5	Energy meter		Dynamometer	1
6	Connecting wires	1sqmm		As required

CIRCUIT DIAGRAM:

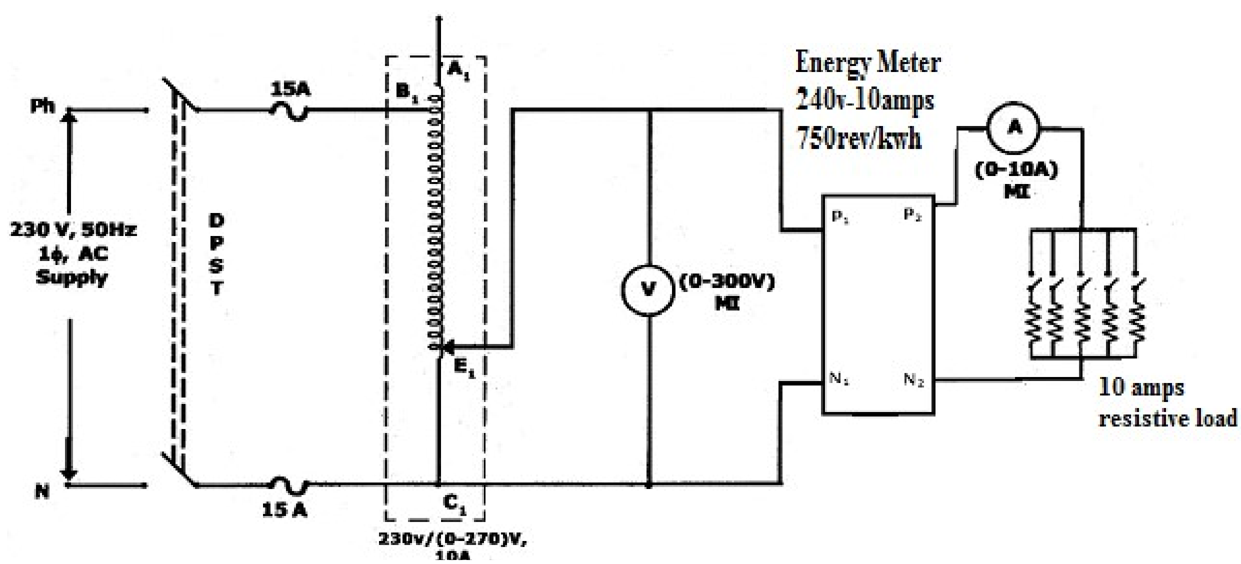


Fig.1-Φ Energy Meter Testing

M – Mains (line)
N – eutral (return)
L -- Load

PROCEDURE:

1. Note the specifications of the energy meter as given on its name plate.
2. suitable ranges of the ammeter and voltmeter such that energy meter canbe tested over its complete range
3. Connect the circuit as shown in the diagram.
4.Before switching on the supply ,ensure that the loading rheostatswitches (all)are open.
5. Note down the initial reading of the energy meter.
6.Set the desired load by selecting a suitable combination of Switches on the loading rheostat.
7.Switch on the supply and wait for the red indicator of the energymeter disc to come in the front. At this moment start the stopwatch. Note down the voltmeter and ammeter readings.
8.Measure the time (T) for (N) revolutions (say 20 revolutions) switch off the stopwatch immediately. Switch off the supply.
9.By adjusting the loading rheostat take 8 to 10 sets of readings covering the full current range of the energy meter and tabulate the observation asin table

OBSERVATION TABLE:

V_S	I_L (A)	Time T (s)	Em=N/M	Ea=(V.I.T)/(1000*3600)	% Error= $\frac{Em-Ea}{Ea}\times100$
230	1	48	6.66×10^{-3}	6.13×10^{-3}	7.66%
230	2	41	6.66×10^{-3}	6.19×10^{-3}	7.59%
230	3	32	6.66×10^{-3}	6.12×10^{-3}	8.64%
230	4	25	6.66×10^{-3}	6.33×10^{-3}	5.21%
230	5	20	6.66×10^{-3}	6.10×10^{-3}	5.20%

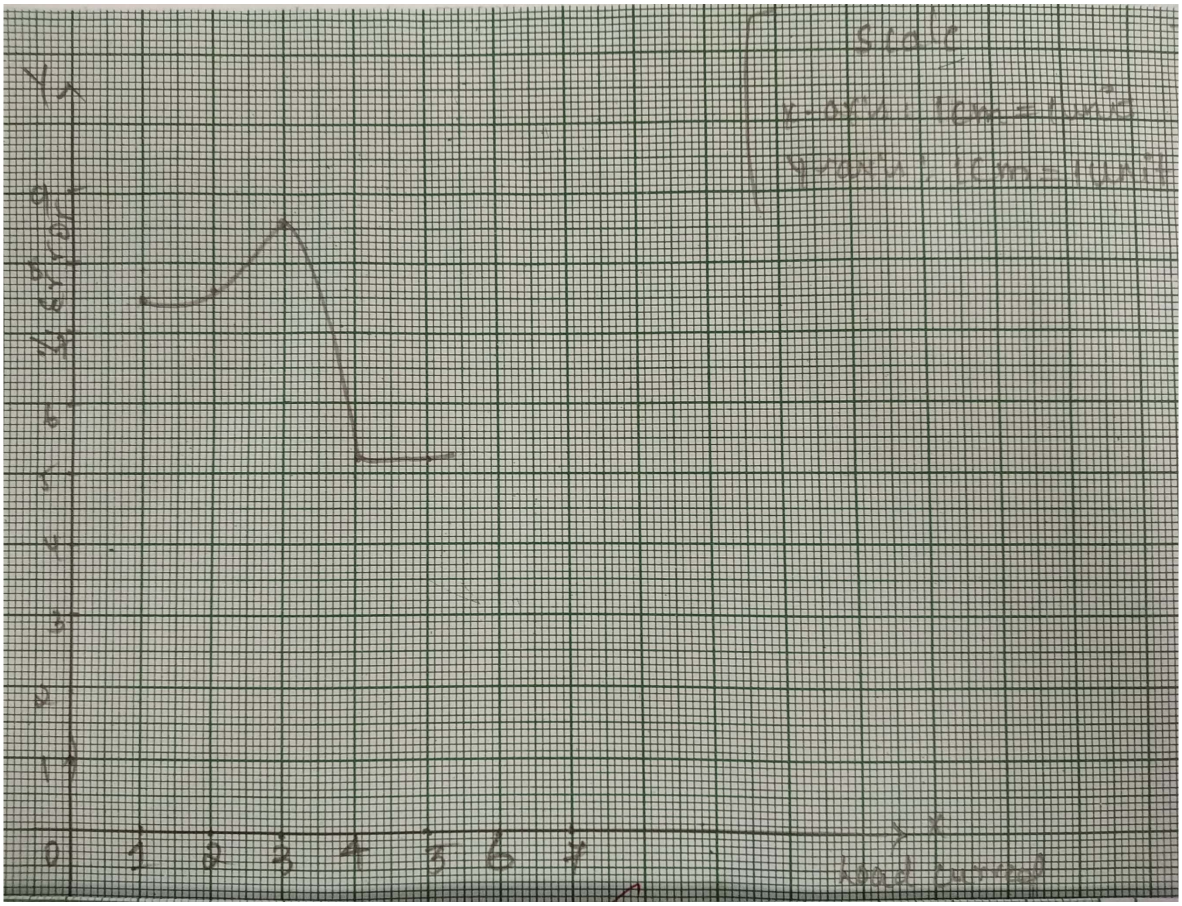
Meter constant M =750 revolutions/kWh

Em =Energy Recorded by the meter

Ea=Actual Energy Consumed During N rev.

Model graph:

Plot the graph % Error Vs Load Current curve:



Result: The given energy meter is calibrated, and also error calculated.

Discussion:

► Possible causes of error in the reading of an energy meter

►Methods for eliminating the errors.

Experiment No: 03

Verification of Network Theorems

AIM:

The objective of this experiment is to verify the

i) Thevenin's Theorem

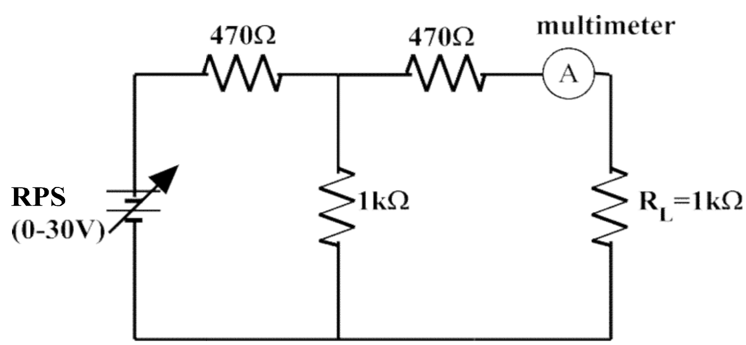
ii) Superposition Theorem

APPARATUS:

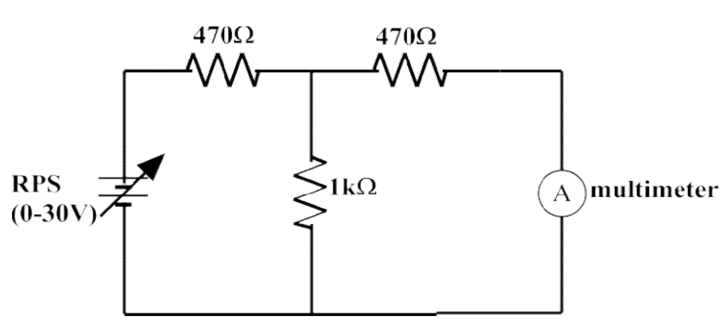
Sl.NO.	Name of the equipment	Range	Type	Qty
1	Resistors	470Ω 470Ω 1k Ω 1k Ω		1 1 1 1
2	Bread board	-	-	1
3	Regulated power supply	0-30V	-	1
4	Multimeter	-	Digital	1
5	Single Stand Wires			AsRequired

Thevenin's Theorem

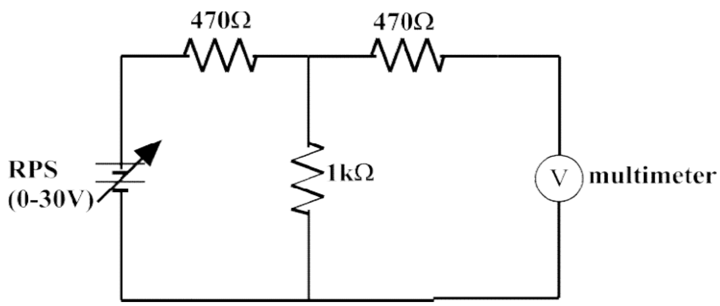
Circuit Diagrams:



(a)



(b)



(c)

Fig1: Circuit Diagram for verification of thevenin's theorem

Procedure:

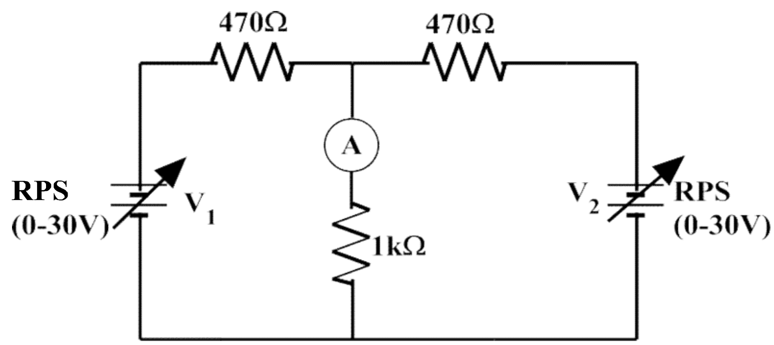
1. Connect the circuit as shown in fig1(a)
2. Switch on the RPS and apply some input voltage (say 30V), observe the load current I_L.
3. Now reconnect the circuit as shown in Fig1(b) and apply the same input voltage as in step 2 and observe the short circuit current(I_{SC}).
4. Now reconnect the circuit as shown in fig1(c) and apply the same input voltage as in step 2 and observe the open circuit voltage which is nothing but the thevenin's voltage(V_{Th}).
5. Now compute the thevenin's equivalent resistance ($R_{Th}=V_{Th}/I_{SC}$).
6. Compute the loadcurrent applying thevenin's theorem as $I_L=V_{Th}/(R_{Th}+R_L)$.
7. Compare the above load current with its observed value in step(2) and verify the theorem.
8. Adjust the input voltage to a new value and repeat the procedure from step(2) to step(7) (Take at least five sets of readings).

Table-I Thevenin's Theorem:

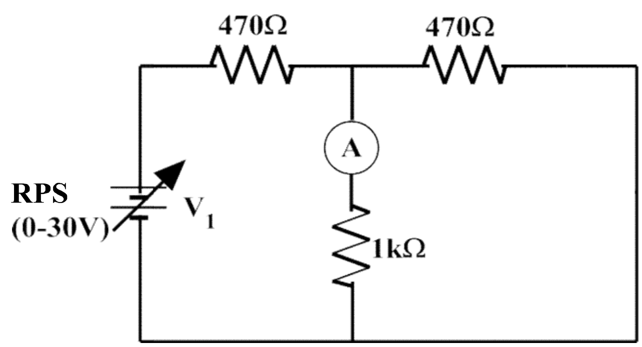
Sl.No.	Source voltage V_S	Observed load current (I_L)ma	I_{SCma}	V_{Th}	$R_{Th}=(V_{Th}/I_{SC})$	Computed load current $(V_{Th}/(R_{Th}+R_L))=I_{Lma}$
1	10	3.8	8.3	6.75	0.813	3.72
2.	20	7.4	16.9	13.4	0.792	7.4

Superposition Theorem:

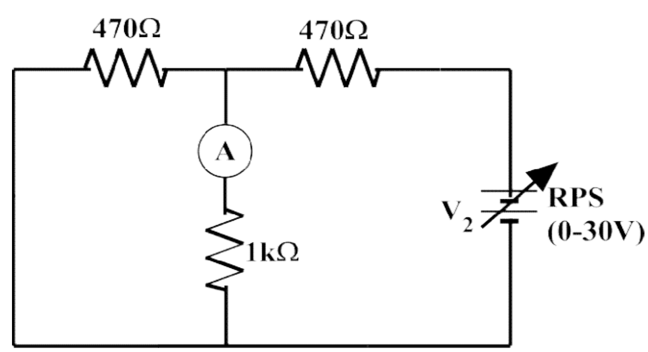
Circuit Diagram:



(a)



(b)



(c)

Fig2: Circuit Diagram for Superposition Theorem

Procedure:

1. Connect the circuit as shown in the Fig2(a), apply some input voltage V_1 and V_2 and observe the current(I) through the 1kΩ resistor.
2. Connect the circuit as shown in fig2(b), and apply the same voltage V_1 as in step1 and observe the current(I_1) through the 1kΩ resistor.
3. Connect the circuit as shown in fig2(c), and apply the same voltage V_2 as in step1 and observe the current (I_2) through the 1kΩ resistor.
4. Compare I with (I_1+I_2) taking care of signs properly to verify the theorem.
5. Repeat the procedure from step1 to step4 for five different combinations of voltages V_1 and V_2

Table – II Superposition Theorem: For $V_{S=}$10,20v

Sl.No.	$I_{T\ ma}$	I_{1ma}	I_{2ma}	Computed current (I_T=I+I_2)ma	Error	%Error
1.	8.3	4.1	4.2	8.3	0	0
2	16.18	8.16	7.99	16.15	0.03	3

RESULT: Hence The thevenins and superposition theorems Are verified .

Discussion:

(i) Can you suggest any alternative procedure for the determination of thevenin's resistance R_{Th}?

(ii) Is there any restriction for the choice of circuit elements?

iii) While considering the effect of a single source, the other source is short circuited why? How far is it justified?

Experiment No: 04

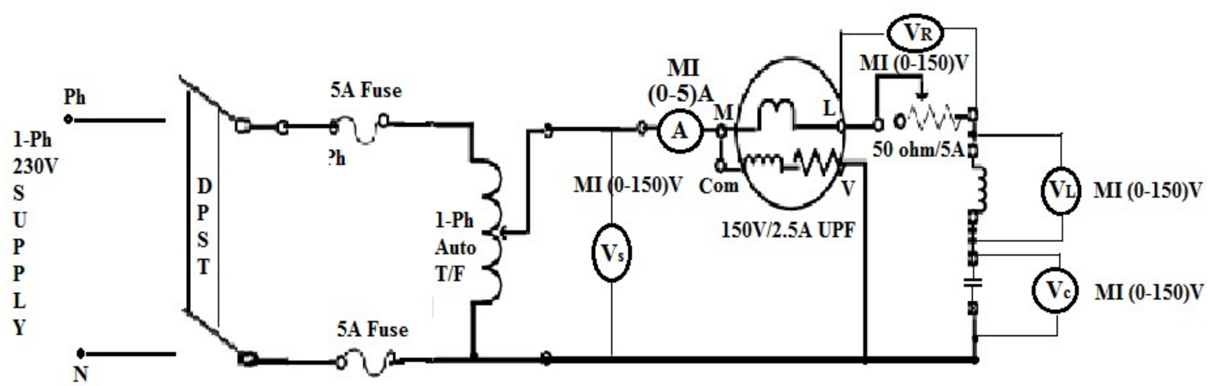
SERIES RLC CIRCUIT

AIM: To study the behavior of a series R-L-C circuit.

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Autotransformer	0-230V		1
2	Ammeter	0-5A	MI	1
3	Voltmeter	0-150v	MI	4
4	Rehostat	50ohm/5 amps	Wirewound	1
5	Wattmeter	150v-5amp-UPF	Dynamometer	1
6	Inductor	35mh		1
7	Capacitor	70micro fraday		1

CIRCUIT DIAGRAM:



PROCEDURE :

1.Connect the circuit as shown in the diagram.
2.Adjust the rheostat for maximum resistance and the auto transformer to the position of zero-output voltage and switch on the supply.
3,Adjust the voltage across the circuit to about 70 V and note I, , , , and W.
4.Adjust the rheostat for several settings and repeat step 3.
5.Adjust the rheostat to the maximum setting and change the capacitance to 140 µF and repeat step 4.
6.Compare the values of phase angle as obtained from the meter readings and from the phasor diagrams. (From the phasor diagrams compute cos θ and θ as given in the last two columns of the table). Draw phasor diagrams showing , , , , for different sets of readings.

Observation Table:

S.N0	Vs	I	W	V_R	V_L	V_C	IV_S	COSθ=W/(V_S.I)	θ From Meter Reading	θ From Phasor
1	70	1.5	55	64	20	20	50	0.52	58.66	25.11
2	70	1.8	64	58	22	22	66	0.507	59.5	37.18
3	70	2.0	70	52	28	28	77	0.5	60	43.29
4	70	2.3	65	42	32	32	91	0.4	66	54.55
5	70	2.5	50	31	35	35	100	0.28	73.73	64.50

RESULT:

The series RLC circuit behaviour is studied and error have been calculated.

DISCUSSION:

1. Do you expect θ to be a constant? Is it so as per your experiment? Why?
2. Is IV equal to W? Compare the difference of wattmeter reading W with R IV cos θ for a few readings and give your comments.
3. Is it possible to have a voltage drop across the energy storage element greater than the supply?

Experiment No: 05

Characteristics of Lamps

AIM:

a) Obtaining the V-I characteristics of the following nonlinear elements

Lamp (L1): 40W, 220V AC Tungsten Lamp

Lamp (L2): 18W, 220V AC, Compact Fluorescent Lamps (CFL).

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Autotransformer	0-230V		1
2	Ammeter	0-0.2A	MI	2
3	Voltmeter	0-300v	MI	1
4	Incandisent lamp,CFL lamp	40w,18w		1

Circuit Diagram:

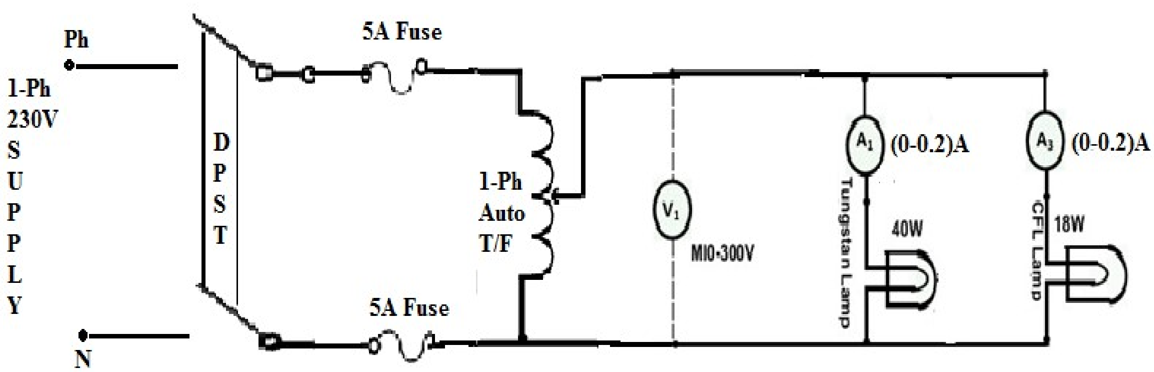


Fig.1 V-I characteristics of the Tungsten and CFL Lamp

Procedure for V-I characteristics of the Tungsten and CFL Lamp

a) Choose the appropriate ratings of the Ammeters, Voltmeters and Fuse wire.
b) Set up the circuit as shown in Fig 1 with the lamps and instruments as indicated. Keep the switch S open.
c) Set the autotransformer for zero output voltage. Close the switch S.
d) Increase the autotransformer output voltage in steps of 20/30 V, until the full voltage (i. e 230V) is obtained. At each step, note the readings of V_1, A_1, A_2 and record them in Table 1.
e) Repeat step (d) decreasing output voltage of auto transformer from full to zero volts.

Observation Table :

S.No	V_1(V)	I_1(A) (Tungsten Lamp)			I_2(A) (CFL Lamp)		
		Inc	**Dec**	**Mean**	**Inc**	**Dec**	**Mean**
1.	40	0.08	0.076	0.078	0.08	0.076	0.078
2	80	0.086	0.102	0.094	0.09	0.086	0.088
3	120	0.11	0.124	0.117	0.086	0.084	0.085
4	160	0.132	0.144	0.138	0.082	0.08	0.081
5	200	0.15	0.162	0.156	0.078	0.078	0.078
6	230	0.16	0.166	0.163	0.074	0.074	0.074

Model graph

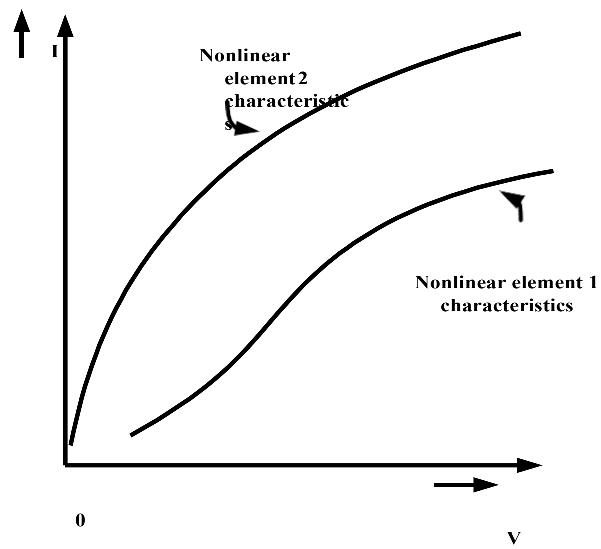


Fig.2 Model graph for V-I characteristics

RESULT:

V-I characteristics of different lamps have been studied.

Discussion Questions:

1. How will you interpret the v-i characteristics of two different incandescent lamps?
2. Why do the readings differ for increasing and decreasing values of the lamp voltages?Discussion Questions:

1. Account for the differences, if any, between the predicted and the observed steady state operating points of the circuit.
2. Why source characteristics will be referred as load line characteristics?

II.FLUORESCENT LAMP:

Aim: To obtain the V-I characteristics of a Fluorescent Lamp

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Autotransformer	0-230V		1
2	Ammeter	0-0.2A	MI	2
3	Voltmeter	0-300v,0-150v	MI	2,1
4	Fluorescent lamp	36w		1

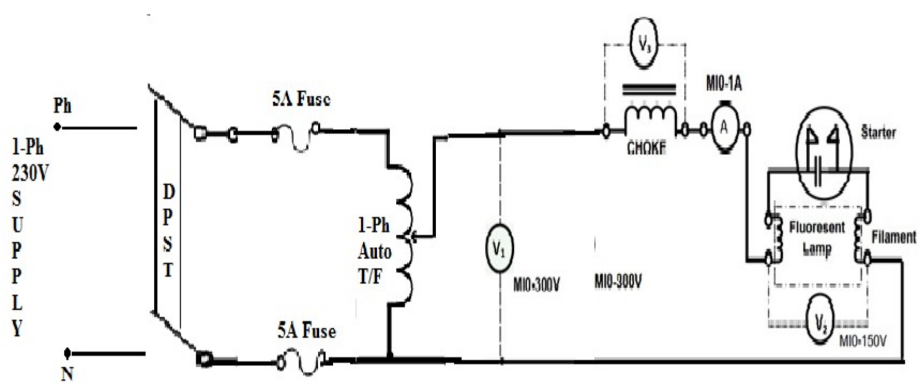


Fig.7 Circuit diagram for testing of a Fluorescent Lamp

Procedure:

1. Set up the circuit as shown in Fig.7 Keep the switch S open.
2. With the autotransformer at zero output position, close the switch S.
3. Increase the autotransformer output gradually until the lamp lights up. Note the meter readings and enter them in the proper column in Table 3.

When the lamp starts to glow, increase the autotransformer output voltage in steps until the rated voltage is obtained. Enter the readings of the meters in Table 3.

4. Decrease the supply voltage in steps until the lamp extinguishes. Record the meter readings

.

Table 3: Fluorescent lamp characteristics.

S.NO.	Vs	V_L	Vc	I_L	Remarks
1	230	106	184	3.6	Full bright
2	210	114	150	2.4	Low bright
3	190	128	124	2.2	Dim
4	150	149	20	0	Light extinguish

V_s = Voltage across the supply = reading of the voltmeter V_1

V_1 = Voltage across the lamp = reading of the voltmeter V_2

V_c = Voltage across the choke = reading of the voltmeter V_3

I_L = Current through the lamp = reading of the ammeter A

RESULT: The characteristics of fluorescent lamps are studied.

Discussion Questions:

1. Plot V_L versus I_L and V_c versus I_L on the same graph sheet.
2. Comment on the nature of the plots. How are V_L and Vc related?
3. Discuss the function of the choke in the lamp circuit. Can it be replaced by a resistor?
4. What is the necessity of a starter? Can a single- pole switch replace it?
5. The voltage needed for starting the glow of the lamp and the voltage when the lamp extinguishes, are not equal. Explain why?
6. If ac supply is replaced by dc, will the circuit work? If not, what changes are to be made?

Experiment No: 06

Magnetization characteristics of separately excited D.C Generator

AIM:

To obtain the magnetization characteristics and critical resistance of a separately excited D.C generator.

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Ammeter	0-2A	MC	1
2	Voltmeter	0-300v	MC	1
3	Rehostats	100Ω/5A,290 Ω/2.3A, 600 Ω/1.7A	wirewound	1 each
4	Spst switch		contact	1

Circuit Diagram:

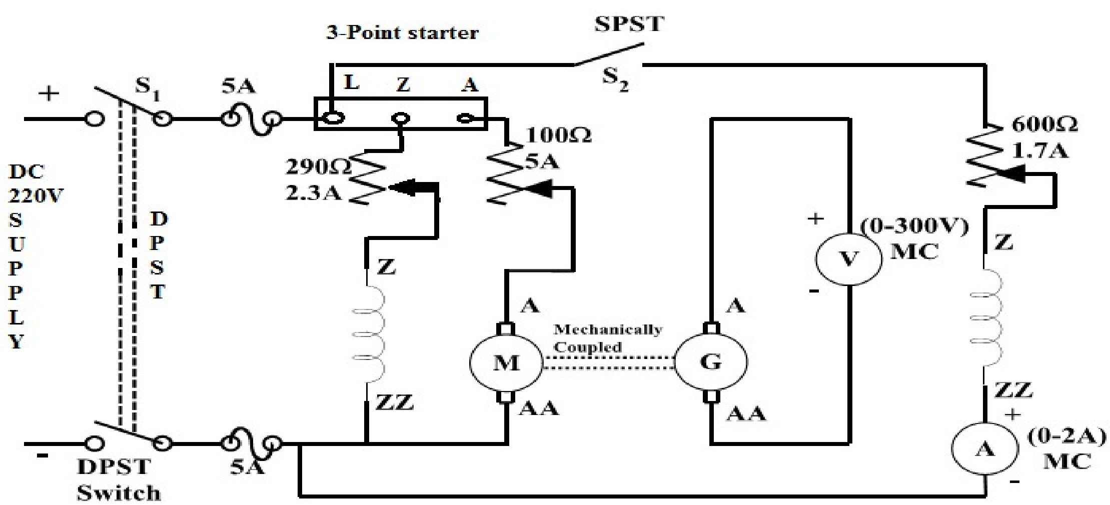


Fig1: Circuit Diagram

Procedure:

1. Chose the appropriate ranges of various meters and connect the circuit as shown in Fig1.
2. Keep S_1 and S_2 in open position.
3. Keep the field rheostat of the motor at its minimum and the armature rheostat of the

motor, field rheostat of the generator should be at their maximum.

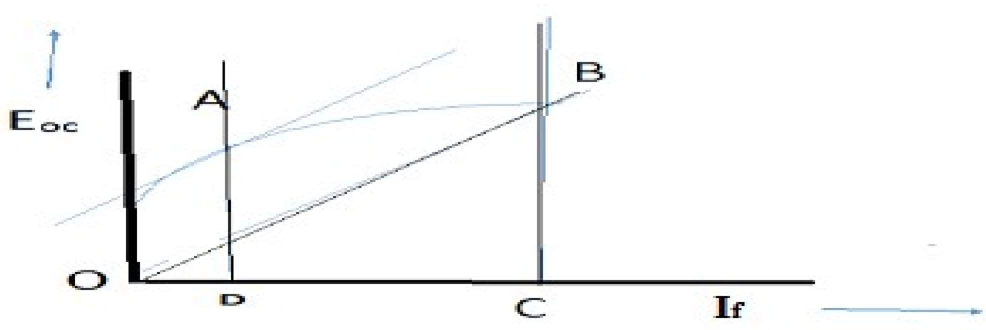
4. Now close the switch S_1 and bring the motor generator set to its rated speed by first decreasing the armature resistance and then by increasing the field resistance of the motor.
5. Now note the generated voltage and the corresponding field current.
6. Now close switch S_2 and by slowly decreasing the resistance connected in series with the field winding of generator, note down the output voltage and the corresponding field current of the generator until the generated voltage becomes 120% of its rated value.

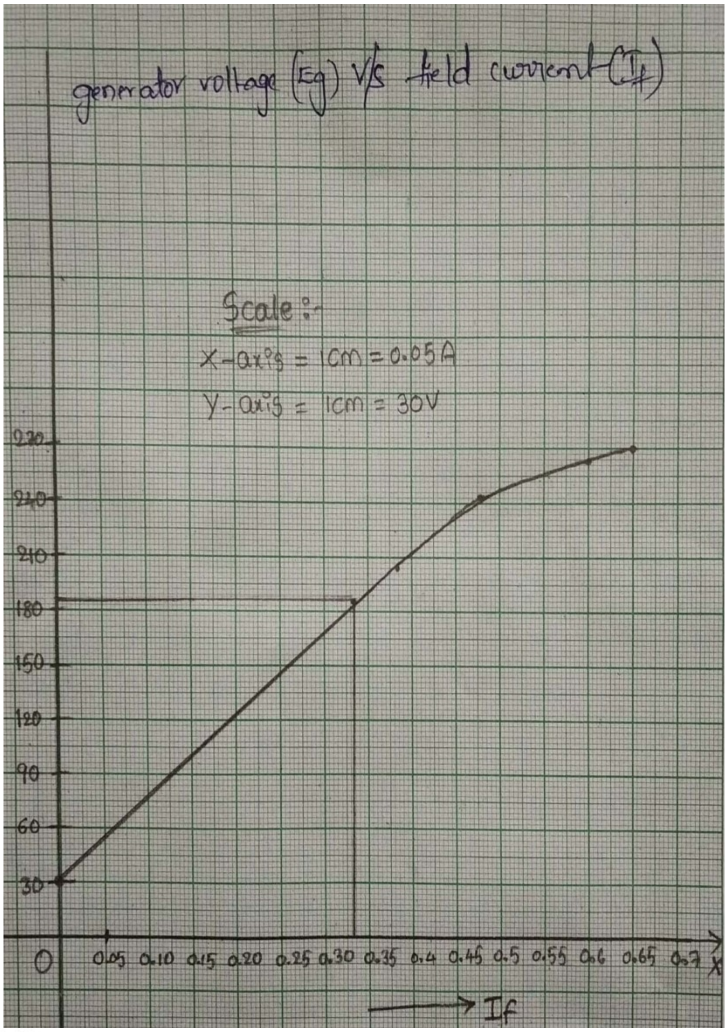
Observation Table :1

SI.NO.	Filed Current(I_f)	Generator output voltage (E_G)
1	0	30
2	0.34	188
3	0.37	194
4	0.47	212
5	0.6	232
6	0.67	240

MODEL GRAPH:

1. The magnetizing characteristics (E_G Vs I_f) of the generator.
2. Determine critical resistance of the generator.





AD/BC=N_c/N

N_C= AD/BC x N

The conditions for satisfactory voltage build up are:

1). Presence of Residual magnetism.

2). Correct direction of rotation.

3). Field Resistance lesser than critical resistance

4). Speed more than critical speed

Results: Magnetisation characteristics of D.C. shunt Generator have been studied.

Discussions:

1. How will a shunt generator behave if the field resistance is greater than the critical resistance?

Experiment No: 07

THREE –PHASE POWER MEASUREMENT

AIM:

To measure power in a three phase circuit under

i) Balanced resistive load condition

ii) Unbalanced resistive load condition

APPARATUS REQUIRED:

S.No	Equipment Name	Range	Type	Quantity
1	Voltmeter	(0-150)V	MI	3No's
2	Ammeter	(0-5)A	MI	3No's
3	Wattmeter	5A,150V	Electrodynamometer type	2No's
4	TPST	-	-	1No's
5	Fuse	5A	-	3No's
6	Rheostat	26Ω/4.1A	Wire wound(Variable)	3No's
7	Gang Rheostat	26Ω/4.1A of each limb	Wire wound(Variable)	1No
8.	3 ph varaic	0-440V		1 No

BALANCED RESISTIVE LOAD

CIRCUIT DIAGRAM:

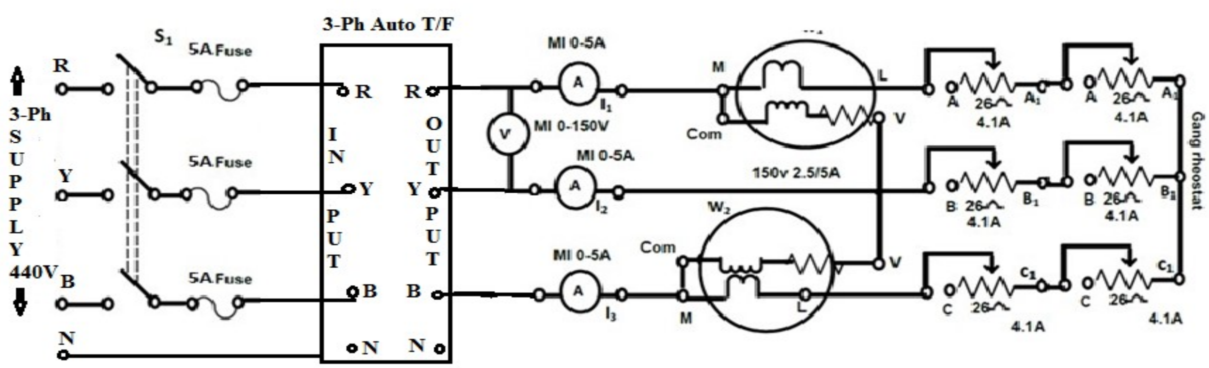


Fig.1 BALANCED RESISTIVE LOAD

PROCEDURE:

1. Connect the circuit as shown in Fig.1
2. Adjust the gang rheostat and Individual rheostats for the maximum resistance.
3. Switch on the supply and set the autotransformer to120V.
4. Close switch S1.
5. Read the meters to obtain VL, I1, I2 and I3. Note the wattmeter reading W1 and W2 (Note the multiplying factor on the wattmeter).
6. Vary the Gang rheostat resistance and obtain at least five sets of observations, the current should not exceed the limit (4.1 A).
7. Tabulate the readings and check the results by completing the calculations

OBSERVATION TABLE -1:

(Three phase power in a balanced load)

S.No.	V_L	I_1	I_2	I_3	W_1	W_2	W_C	W_M W_1+W_2	%Error $\frac{W_M - W_C * 100}{W_C}$
1	120	1.25	1.4	1.4	160	133	280.59	293	4.42%
2	120	1.35	1.6	1.5	163	133	308.30	296	-3.98%
3	120	1.65	1.7	1.5	173	152	339.48	325.5	-4.11%
4	120	2.45	2.6	2.4	276	250	516.15	526	1.90%

UNBALANCED RESISTIVE LOAD

CIRCUIT DIAGRAM:

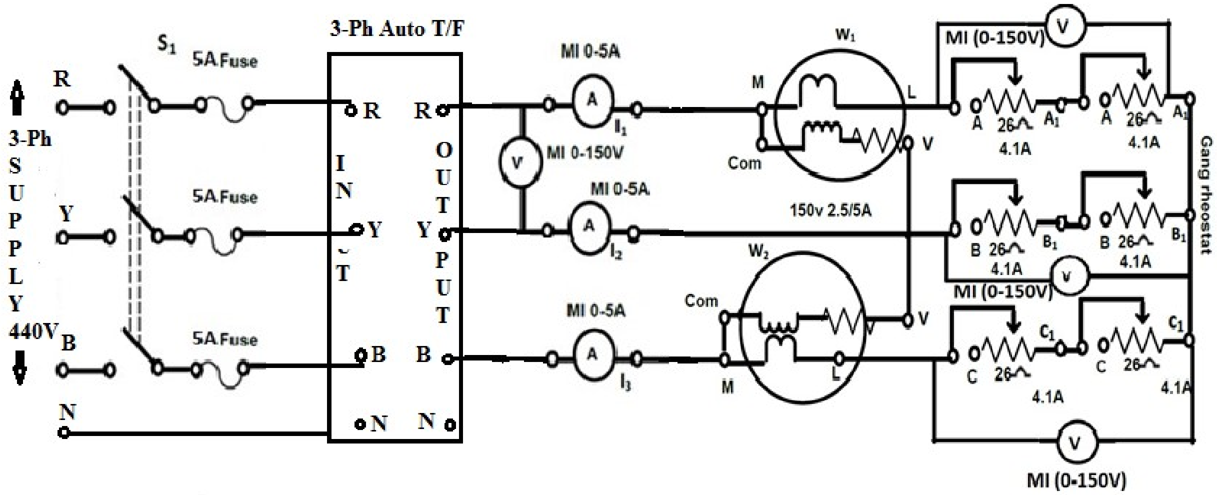


Fig.2 UNBALANCED RESISTIVE LOAD

PROCEDURE:

1. Connect the circuit as shown in Fig. 2.
2. Adjust the three rheostats and gang rheostat at the maximum values.
3. Switch on the supply and set the autotransformer to120V.
4. Close switch S1 and take five sets of observation for different rheostat settings such that the reading of I1, I2 and I3 in each set is appreciably different to create unbalanced loading condition. (Don't vary the gang rheostat).The current should not exceed the limits in each arm.
5. Note down I_1,I_2,I_3,V_1,V_2,V_3,W_1 and W_2. Check the result by completing the computations indicated in Table.2.
6.

OBSERVATION TABLE -2

(Three phase power in an unbalanced load)

S.No.	**V_1**	**V_2**	**V_3**	**I_1**	**I_2**	**I_3**	**W_1**	**W_2**	**W_C**	**W_M W_{1+} W_2**	**%Error $\frac{W_M - W_C * 100}{W_C}$**
1	85	72	54	1.4	1.9	2	210	150	368.05	360	-2.18%
2	75	55	80	1.8	2.1	1.4	210	142.5	362.5	352.5	-2.75
3	58	80	73	2.1	1.65	1.7	140	222.5	377.9	362.5	-4.07%
4	67	65	65	1.12	1.25	1.9	150	150	283.37	300	5.6%

RESULT:

The three phase power is measured by two wattmeter method is studied and error had been calculated.

DISCUSSION:

1. What do you understand by a balanced and unbalanced three-phase load?
2. How would you measure power using a) Three watt meters and b) One wattmeter for balanced/unbalanced loads?
3. Is it possible to measure power factor of the balanced (three–phase load by two-wattmeter method)?
4. What is the difference between three-phase balanced load and balanced power supply?

Experiment No: 08

SINGLE PHASE TRANSFORMER

AIM:

To determine the efficiency and regulation of a single phase transformer by conducting (a) open circuit test and (b) short circuit test.

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Autotransformer	0-230V		1
2	Ammeter	0-2.5A	MI	1
3	Voltmeter	0-150v	MI	1
4	Wattmeter	150v,2.5 amp LPF	dynamometer	1
5	1 PH Transformer	1.5 KVA		1
6	Connecting Wires	1sqmm		As Required

OPEN CIRCUIT TEST:

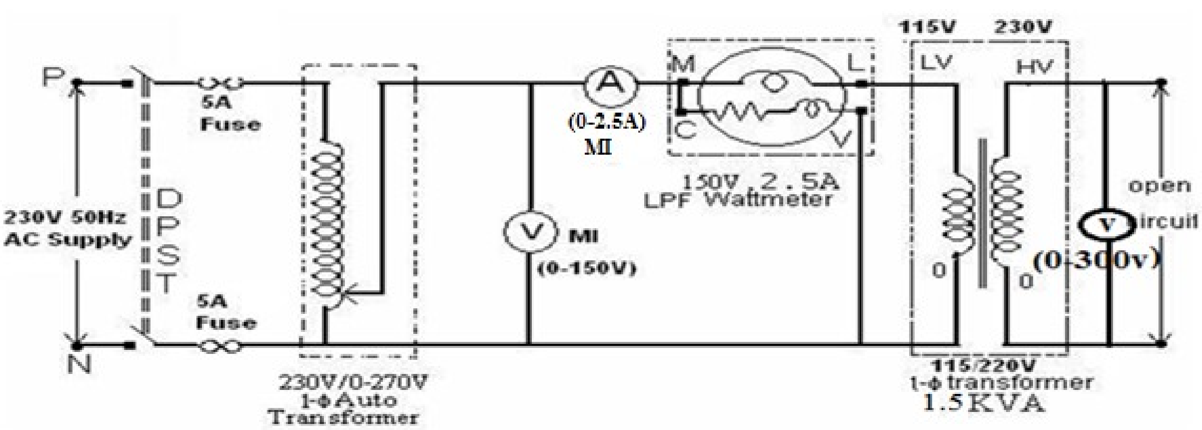


Fig. O.C Test on 1-Φ Transformer

PROCEDURE:

i) Connect the circuit as shown in Fig- 1 choosing suitable instruments.

ii) Switch on the supply, keeping the output voltage of the autotransformer at zero. Increase the voltage in steps up to rated value and tabulate the no load current, input power, and the primary & secondary voltages corresponding to the applied voltage in Table no. 1

Observation Table :

S.NO	Primary Voltage L.V.Side (V)	Primary Current I_{amps}	Input Power (w)	Secondary Voltage H.V side(V)
1	115	0.8	22	230

(b).SHORT CIRCUIT TEST:

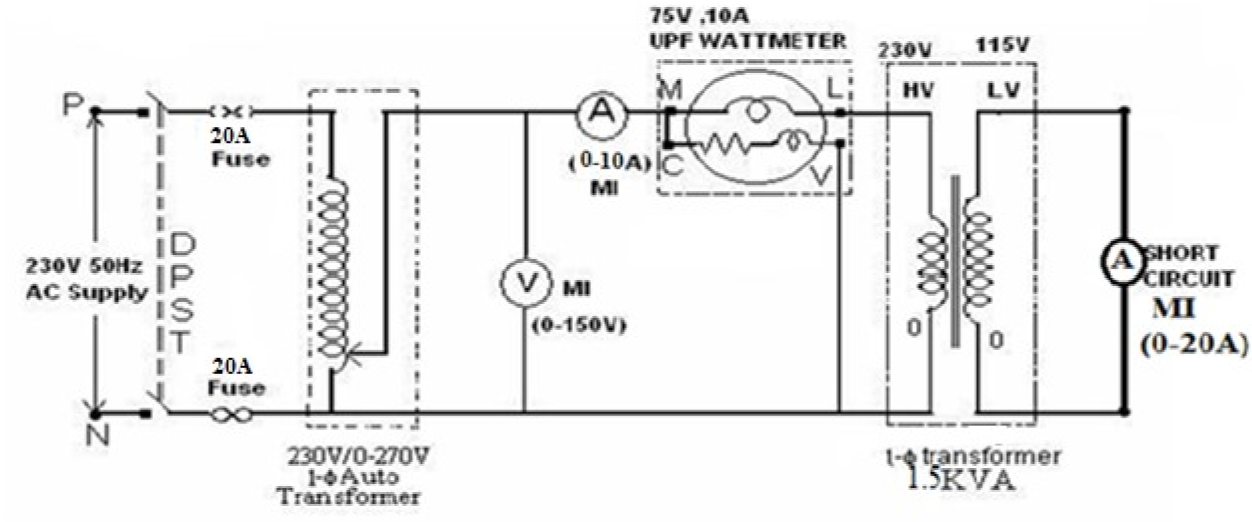


Fig. S.C Test on 1-Φ Transformer

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	Autotransformer	0-230V		1
2	Ammeter	0-10A,20A	MI	1,1
3	Voltmeter	0-30v	MI	1
4	Wattmeter	150v,10 amp UPF	dynamometer	1
5	1 PH Transformer	1.5 KVA		1

PROCEDURE:

I. Connect the circuit as shown in Fig-2, choosing instruments of suitable range to go up to rated current.

II. Keeping the output voltage of the autotransformer at zero, switch on the circuit. Increase the output voltage slowly and observe the primary and secondary currents carefully (Note The current flowing through the windings must not exceed their rated level.)

III. Adjust the output voltage of the autotransformer to get secondary short circuit current of 25%, 50%, 75% and 100% of the rated current. Note down the value of the input voltage, input current, power and the secondary current in table no.2

Observation Table :

S.NO	Primary Voltage H.V.Side (V)	Primary Current I $_{amps}$	Input Power (w)	Secondary Current H.V side(amps)
1	19	6.5	128	13

RESULT:

The O.C and S.C tests are conducted on single phase transformer. And efficiency and regulation are calculated.

Discussion:

1). Why is OC test carried out by energising LVside?

2). Why is SC test carried by energising side?

3). When is the efficiency maximum in a transformer?

4). How do no load losses arise in a transformer?

Experiment No: 09

SPEED CONTROL OF DC SHUNT MOTOR

AIM:

To study the variation of speed of a. d. c. shunt motor.

i) With armature voltage under constant field excitation , and

ii) With field excitation under constant armature voltage.

APPARATUS:

Sl.NO.	Name of the equipment	Range	Type	Qty
1	DC Shunt motor expt setup			1
2	Ammeter	0-1A,0-5A	MC	1
3	Voltmeter	0-300	MC	1
4	Rehostats	185 Ω /1.5A,40 Ω/6.7A	wirewound	1 each
5	Connecting Wires	1sqmm		As Required

CIRCUIT DIAGRAM:

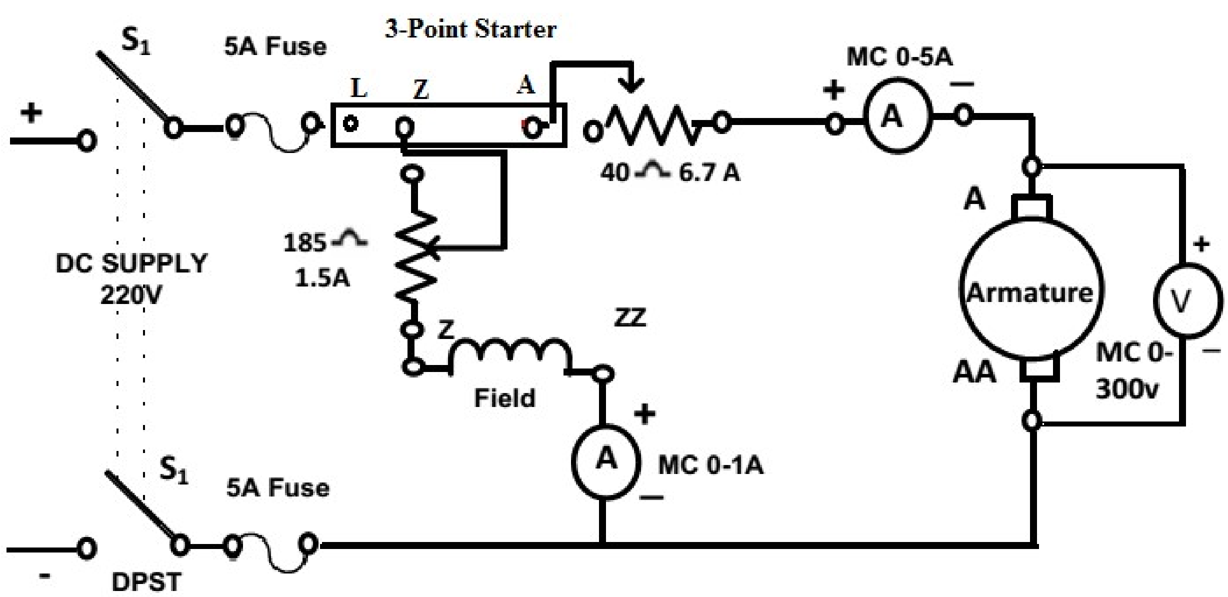


Fig 1. Speed Control of D.C. Shunt Motor

PROCEDURE:

i) Connect the circuit as shown in figure – 1.

ii) Start the motor with maximum resistance in the armature circuit and minimum resistance in the field circuit.

iii) Bring the motor to the rated speed, first by decreasing the resistance in the armature circuit and then by increasing the resistance in the field circuit.

iv) Vary the resistance in the field circuit and take readings of speed and field current, keeping the armature voltage constant at a particular value.

v) Change armature voltage to another value and repeat the procedure given in(iv)

vi) Then change the resistance in the armature circuit and take reading of speed and armature vo ltage, keeping the field current constant at a particular value.

vii) Change the field current to another value, repeat the procedure given in (vi).

viii) Take three sets of readings for each method of variation.

OBSERVATION :

Table I: Variation of speed with field excitation.

SI.No	Field current (I_F amps)	Speed N (rpm)	Constant Armature Voltage(V)
1	0.67	1500	216
2	0.6	1530	216
3	0.55	1585	216
4	0.5	1600	216
5	0.4	1620	216

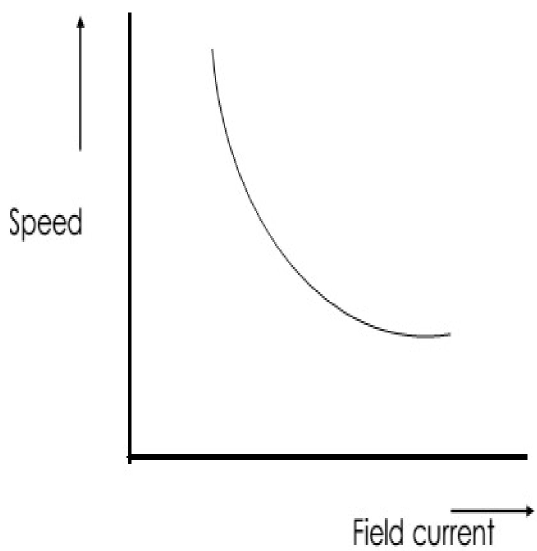
Table II. Variation of speed with armature voltage.

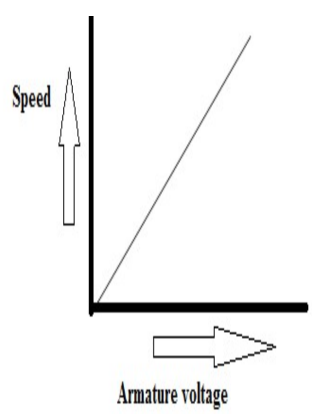
SI.No	Armature Voltage(V)	Speed N(rpm)	Constant Field Current (I_F amps)
1	216	1500	0.66
2	212	1470	0.66
3	208	1430	0.66
4	204	1350	0.66
5	200	1310	0.66

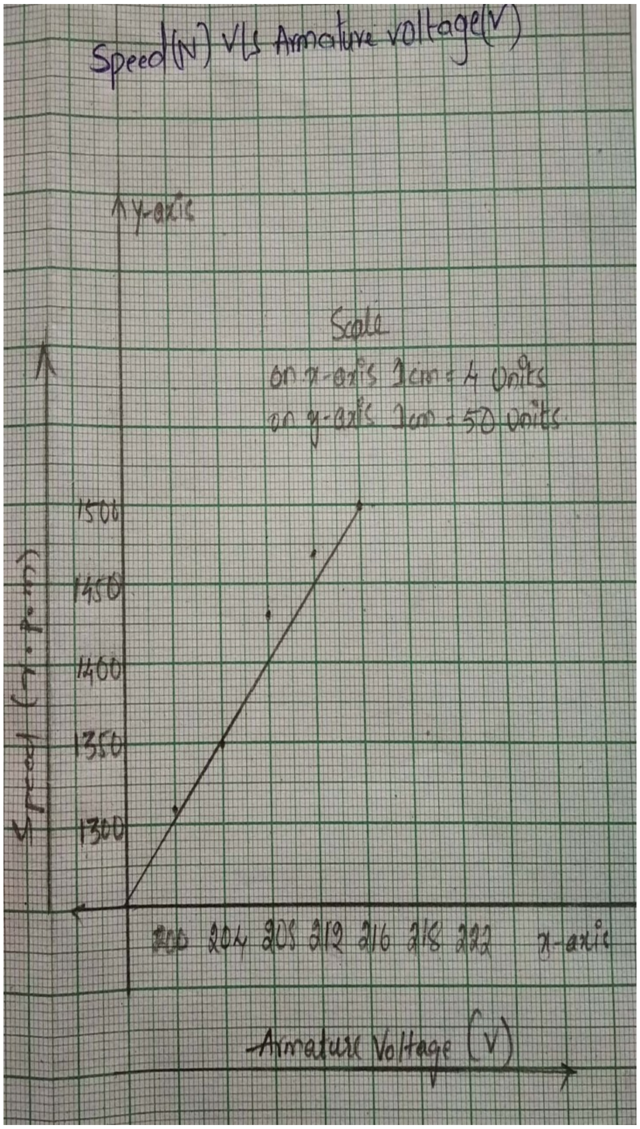
MODEL GRAPH

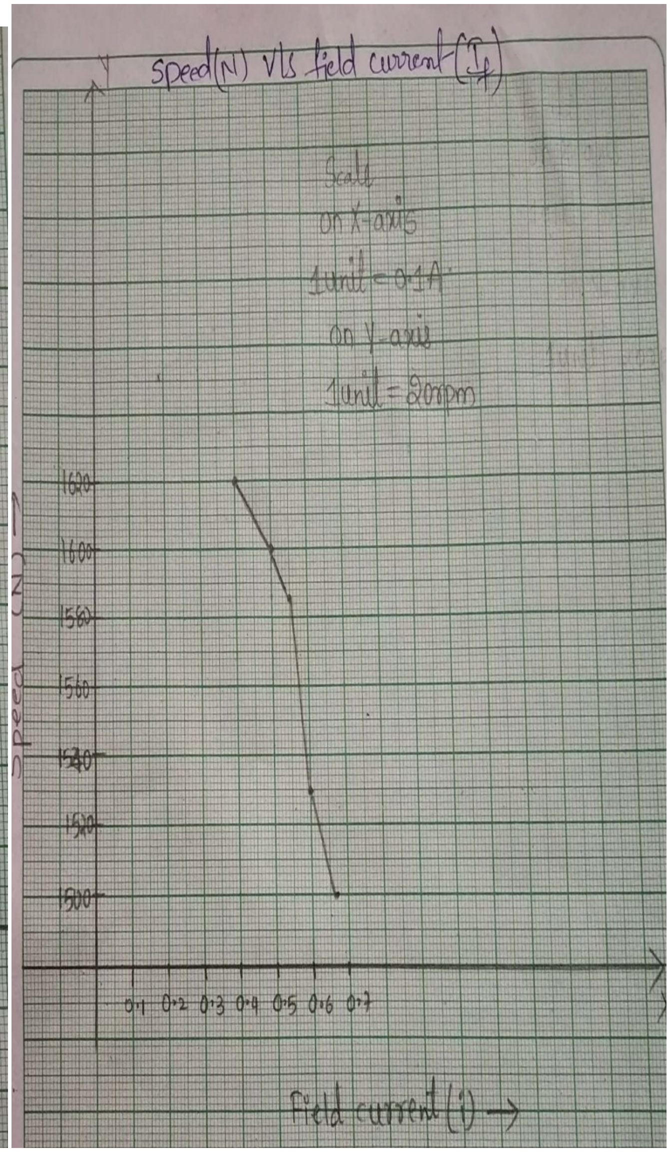
i) Plot speed against field current for different sets of constant armature voltage on a graph paper.

ii) Plot speed against armature voltage for different sets of constant field current on another graph paper.






Speed(N) V/s Armature voltage(V)
y-axis
Scale
on x-axis 1cm = 4 units
on y-axis 1cm = 50 units
1500
1450
1400
1350
1300
Speed (r.p.m)
200 204 208 212 216 218 222
x-axis
Armature Voltage (V)


Speed(N) V/s field current (If)
Scale
on X-axis
1unit = 0.1A
on Y-axis
1unit = 20rpm
Speed (N)
0.1 0.2 0.3 0.4 0.5 0.6 0.7
Field current (i)

RESULTS :

The field control method and armature control method on D.C shunt motor is studied.

DISCUSSION :

i) Discuss and explain about the nature of the plots with relevant equations.

ii) Discuss about the limitations and merits of the two methods of speed control.

iii) Why do you keep the resistance in the armature circuit at a maximum, and resistance in the field circuit a minimum at start?

iv) What will happen when the field circuit gets opened, while the machine is running