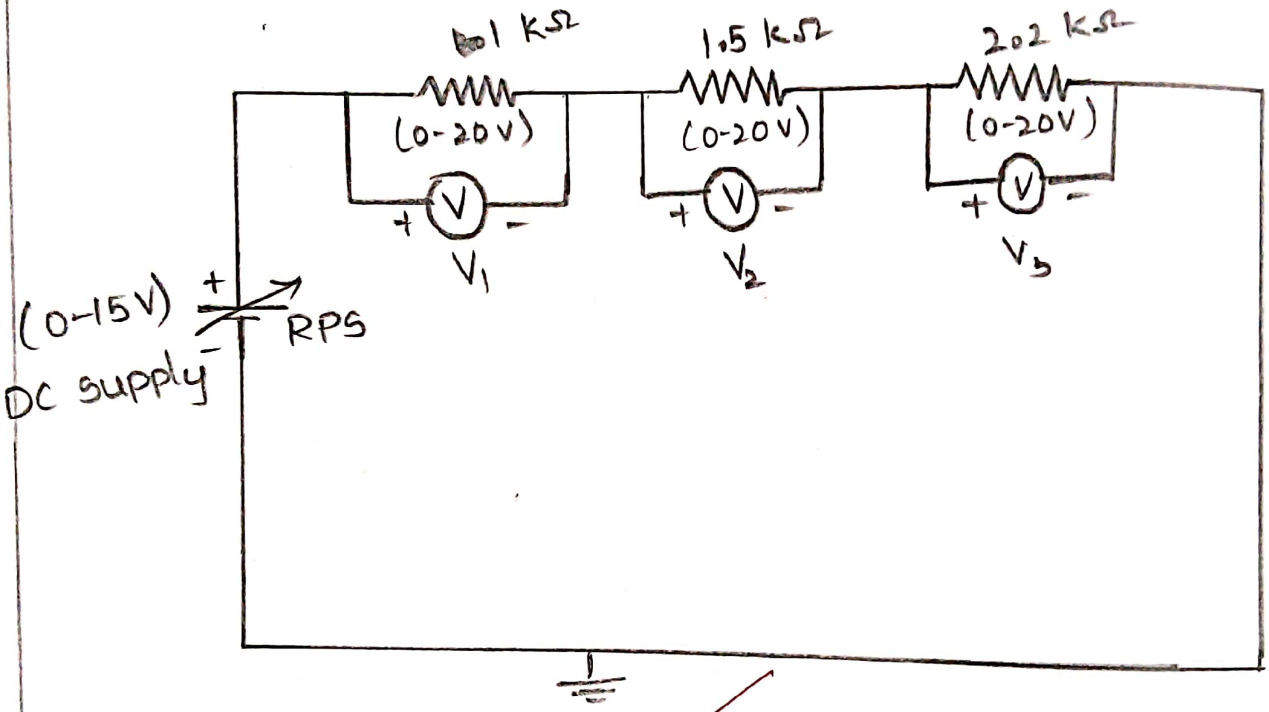
INDEX

CIRCUIT DIAGRAM



~~Verification of KVL~~

VERIFICATION OF KVL ~~AND~~ KCL :

Aim: To verify kirchhoff's voltag law (KVL) in a resistive network.

Apparatus:

S.NO	Apparatus	Range	Type	Quantity.
1.	KVL kit	(0-15V)	-	1
2	Ammeter	(0-1 A)	MC	3
3.	Voltmeter	(0-20V)	MC	3
4	Resistor	1kΩ, 2.2kΩ, 1.5kΩ	-	3
5.	Bread board	-	-	1
6.	Connecting wires	-	-	As required

Theory:

1. kirchhoff's Second Law - The voltage law, (KVL)
kirchhoff's voltage law or KVL, states that "in any closed loop network, the total voltage around the loop is equal to the sum of all the voltage drops within the same loop" which is also equal to zero. In other words

observations:—

For KVL

Applied voltage V (volts)	V_1 (volts)		V_2 (volts)		V_3 (volts)		$V = V_1 + V_2 + V_3$ (volts)	
	theoretical	practical	theoretical	practical	theoretical	practical	theoretical	practical
4.26 V	0.90	0.90	1.35	1.37	1.98	1.98	4.25	4.23
5.1 V	1.08	1.07	1.62	1.63	2.4	2.4	5.1	5.1
7 V	1.48	1.48	2.22	2.22	3.25	3.29	6.95	6.99
9.4 V	2	1.99	3	3	4.4	4.4	9.39	9.4
15.0 V	3.19	3.19	4.78	4.78	7.01	7.0	14.98	14.98

the algebraic sum of all voltages within the loop must be equal to zero. The idea by Kirchhoff is known as the Conservation of Energy.

Procedure :

To verify KVL :-

1. Connect the circuit diagram as shown in figure 1.
2. Switch ON the supply to RPS.
3. Apply the voltage (say 5V) and note down the Voltmeter readings.
4. Gradually increases the supply voltage in steps.
5. Observe the readings of Voltmeter.
6. Sum up the voltmeter readings (voltage drops) that should be equal to applied voltage.
7. Thus, KVL is verified practically.

Calculations!

1. $I = 0.90 mA$; $V = IR$

$V_1 = 0.90 \times 1 = 0.90\ V$

$V_2 = 0.90 \times 1.5 = 1.035\ V$ ⇒

$V_3 = 0.90 \times 2.2 = 1.98\ V$

2. $I = 1.085\ mA$

$V_1 = 1.08 \times 1 = 1.08\ V$

$V_2 = 1.48 \times 1.5 = 1.62\ V$

$V_3 = 1.48 \times 2.2 = 2.37 V = 2.4 V$

3. $I = 1.48 mA$

$V_1 = 1.48 \times 1 = 1.48\ V$

$V_2 = 1.48 \times 1.5 = 2.22\ V$

$V_3 = 1.48 \times 2.2 = 3.256\ V$

4 $I = 2\ mA$

$V_1 = 2 \times 1 = 2\ V$

$V_2 = 2 \times 1.5 = 3\ V$

$V_3 = 2 \times 2.2 = 4.4\ V$

5. $I = 3.19\ mA$

$V_1 = 3.19 \times 1 = 3.19 V$

$V_2 = 3.19 \times 1.5 = 4.78 V$

$V_3 = 3.19 \times 2.2 = 7.01 V$

Date :

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Precautions:

1. Check for proper Connections before Switching ON the Supply.
2. Make sure of proper colour coding of resistor.
3. The terminals of the resistance should be properly Connected.

Result:

Verification of KVL is done by practically and Theoretically.

V. good

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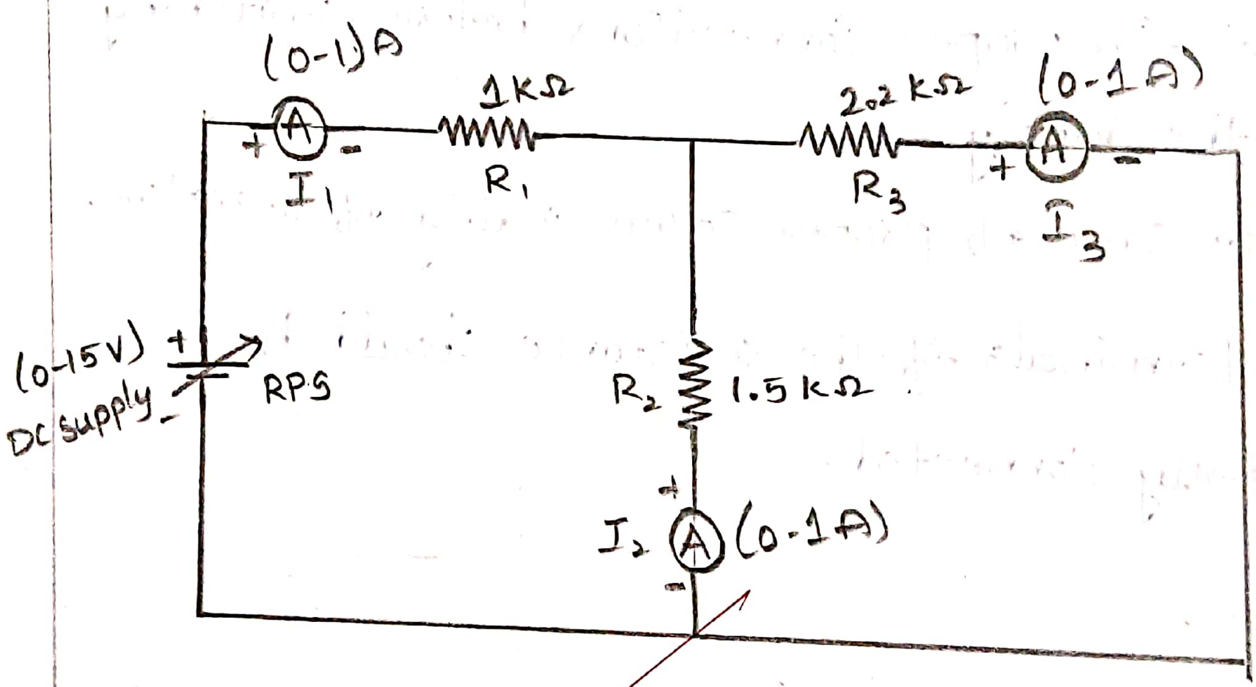
Circuit diagram :



Verification of KCL

VERIFICATION OF KCL

Aim: To verify kirchhoff's Current law (KCL) in a resistive network.

Apparatus:

S.No	Name of the Equipments	Range	Type	Quantity
1.	(RPS) ~~or~~ KCL kit	(0-15 V)	-	1
2	Ammeter	(0-1 A)	MC	3
3	Resistors	1kΩ, 2.2kΩ, 1.5kΩ,	-	3
4	Bread board	-	-	-
5	Connecting wires	-	-	As required

observations:

FOR KCL:

Applied voltage V(volts)	I (A)		I_2 (A)		I_3 (A)		$I = I_1 + I_2 + I_3$ (A)	
	theoretical	practical	Theoretical	practical	theoretical	practical	Theoretical	practical
20 V	0.002	0.002	0.001	0.001	0.001	0.001	0.002	0.002
6 V	0.006	0.007	0.004	0.004	0.002	0.003	0.006	0.007
8 V	0.008	0.009	0.005	0.006	0.003	0.003	0.008	0.009
10 V	0.010	0.012	0.006	0.007	0.004	0.005	0.010	0.012
12 V	0.012	0.015	0.008	0.009	0.005	0.006	0.013	0.015
15 V	0.015	0.019	0.011	0.011	0.007	0.008	0.018	0.019

Theory:

Kirchhoff's first law - The Current law (KCL)

Kirchhoff's current law or KCL, states that the "total current or charge entering a junction or node is exactly equal to the charge leaving the node as it has no other place to go except to leave, as no charge is lost within the node". In other words the algebraic sum of ALL the [circuits entering] currents leaving and entering a node must be equal to zero, I (exiting) + I (entering) = 0. This idea by kirchhoff's is commonly known as the Conservation of charge.

Procedure:

To verify KCL:

1. Connect the circuit diagram as shown in figure 2.
2. Switch ON the supply to RPS.
3. Apply the voltage (say 5V) and Note down the Ammeter readings.
4. Gradually increases the supply voltage in steps.

Calculations: For I(A)

$V = IR$, $I = \frac{V}{R}$

1) $V = 2V$, $R = 1k\Omega \Rightarrow I = \frac{2}{10^3} = 0.002$ A

2) $V = 6V$, $R = 1k\Omega \Rightarrow I = 6/10^3 = 0.006$ A

3) $V = 8V$, $R = 1k\Omega \Rightarrow I = 8/10^3 = 0.008$ A

4) $V = 10V$, $R = 1k\Omega \Rightarrow I = 10/10^3 = 0.010$ A

5) $V = 12V$, $R = 1k\Omega \Rightarrow I = 12/10^3 = 0.012$ A

6) $V = 15V$, $R = 1k\Omega \Rightarrow I = 15/10^3 = 0.015$ A

For I_1(A)

1) $V = 2V$, $R = 1.5\Omega \Rightarrow I_1 = 2/1.5\times10^3 = 0.001$ A

2) $V = 6V$; $R = 1.5\Omega \Rightarrow I_1 = 6/1.5\times10^3 = 0.004$ A

3) $V = 8V$, $R = 1.5\Omega \Rightarrow I_1 = 8/1.5\times10^3 = 0.005$ A

4) $V = 10V$, $R = 1.5\Omega \Rightarrow I_1 = 10/1.5\times10^3 = 0.006$ A

5) $V = 12V$, $R = 1.5\Omega \Rightarrow I_1 = 12/1.5\times10^3 = 0.008$ A

6) $V = 15V$, $R = 1.5\Omega \Rightarrow I_1 = 15/1.5\times10^3 = 0.011$ A

For I_2(A)

1) $V = 2V$, $R = 2.2k\Omega \Rightarrow I_2 = 2/2.2\times10^3 = 0.001$ A

2) $V = 6V$, $R = 2.2k\Omega \Rightarrow I_2 = 6/2.2\times10^3 = 0.002$ A

3) $V = 8V$, $R = 2.2k\Omega \Rightarrow I_2 = 8/2.2\times10^3 = 0.003$ A

4) $V = 10V$, $R = 2.2k\Omega \Rightarrow I_2 = 10/2.2\times10^3 = 0.004$ A

5) $V = 12V$, $R = 2.2k\Omega \Rightarrow I_2 = 12/2.2\times10^3 = 0.005$ A

6) $V = 15V$, $R = 2.2k\Omega \Rightarrow I_2 = 15/2.2\times10^3 = 0.006$ A

Date :

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5. Note the readings of Ammeter.

6. Sum up the Ammeter readings (I_1 and I_2) that should be equal to total current (I)

7. Thus, KCL is verified practically.

Precautions:

1. Check for proper connections before switching ON the Supply.
2. Make sure of proper colour coding of resistors.
3. The terminal of the resistance should be properly connected.

Result:

Verification of KCL is done by praticeally and Theoretically.

Good

O.K

Calculations: For I (A)

CIRCUIT DIAGRAM

To find out I :

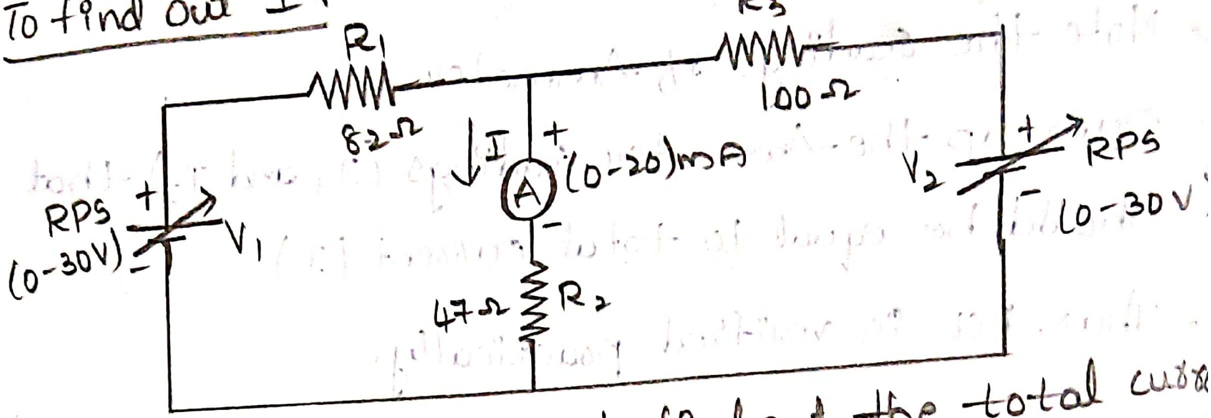

figure 1: circuit diagram to find out the total curr

To find out I_1 :

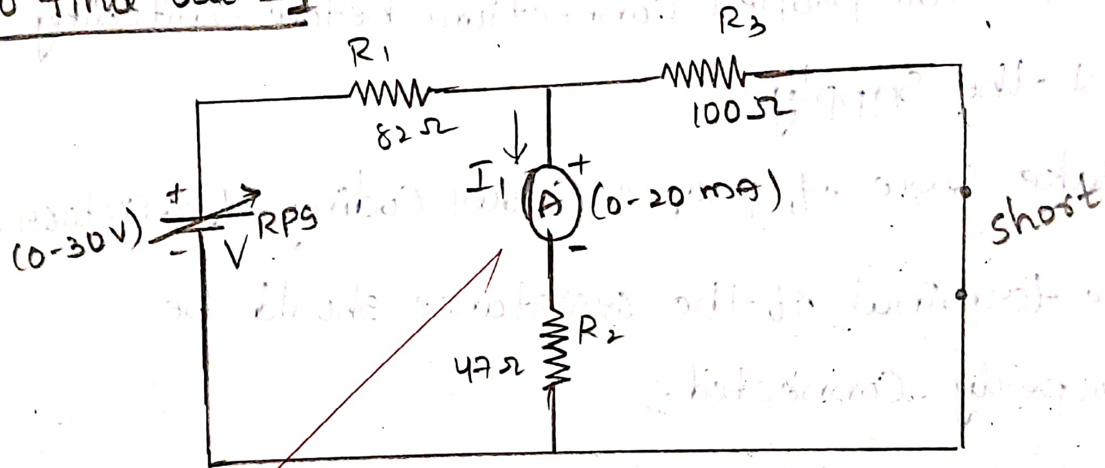

figure 2: circuit diagram to find out the current.

To find out I_2 :

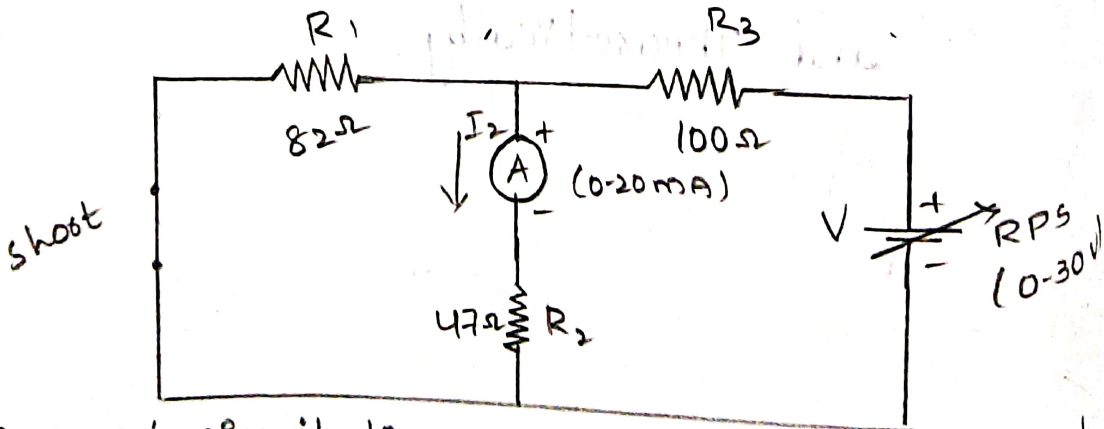

figure 3: circuit diagram to find out the current

Date :

Experiment No.

Sheet No. 08

VERIFICATION OF SUPERPOSITION THEOREM

Aim: To verify the superposition theorem for the given circuit.

Apparatus Required:

S.NO	Name of the Equipment	Range	Type	Quantity
1.	kit of superposition	-	-	1
2	Regulated power supply	0-30V	Digital	1
3.	Digital Ammeter	(0-20)mA	Digital	1
4.	Digital voltmeter	(0-30)V	Digital	1
5.	Resistors	82Ω, 100Ω 47Ω	-	3
6.	Connecting wires	-	-	As required

Theory: SUPERPOSITION THEOREM :-

Superposition theorem states that in a lumped, linear, bilateral network consisting more number of sources each branch current (voltage) is the algebraic sum all currents (branch voltages), each of which is observations:

Table 1 : Total current I value for figure 2

V_1 (volts)	V_2 (volts)	I (mA)
2V	0	0.014

Table 2 : Total current I_1 value for figure 3.

V_1 (volts)	V_2 (volts)	I_1 (mA)
0	4V	0.014

Table 3 : Total current I_2 value for figure 1.

V_1 (vots)	V_2 (volts)	I_2 (mA)
2V	4V	0.014

Date :

Experiment No.

Sheet No. 09

determined by considering one source at a time & removing all other sources. In removing the sources, voltage & current sources are replaced by internal resistance.

Procedure:

1. Make the connections as per the circuit diagram shown in fig 1.
2. Adjust chanel-1 voltage to 20V & channel-2 to 10V
3. Note down the ammeter readings in Table 1.
4. Switch off RPS & Make the connections as per the circuit diagram shown in figure 2.
5. Adjust the channel-1 voltage to 20V
6. Note down ammeter readings in Table-2.
7. Switch off RPS & Make the connections as per the circuit diagram shown in fig 3
8. Adjust the channel-2 voltage to 10V.
9. Note down the ammeter readings in Table 3.
10. Switch off RPS and remove the connections.

Calculations:

To find out I_1:

$$R_{eq} = \frac{47 \times 100}{47+100} + 82$$

$$\boxed{R_{eq} = 113.9\,\Omega}$$

$$I_N = \frac{V}{R} = \frac{2}{113.9} = 0.017\text{ A} \Rightarrow \boxed{I_N = 0.017\text{ A}}$$

$$I_1 = I_N\left(\frac{R_3}{R_2+R_3}\right) = 0.017\left(\frac{100}{47+100}\right)$$

$$\boxed{I_1 = 0.0115\text{ A}}$$

To find out I_2

$$R_{eq} = \frac{82 \times 147}{82+147} + 100$$

$$\boxed{R_{eq} = 129.87\,\Omega}$$

$$I_N = \frac{V}{R} = \frac{4}{129.87} = 0.0308\text{ A} \Rightarrow \boxed{I_N = 0.0308\text{ A}}$$

$$I_2 = I_N\left(\frac{R_1}{R_1+R_2}\right) = 0.0308\left(\frac{82}{82+47}\right)$$

$$\boxed{I_2 = 0.018\text{ A}}$$

Total current $I = I_1 + I_2$

$$I = 0.011 + 0.018$$

$$\boxed{I = 0.029\text{ A}}$$

Date :

Experiment No.

Sheet No. 10

(3)

Precautions:

1. Avoid loose Connections.
2. Note down the readings without any offset.

Result:

Superposition theorem verified Experimentally.

Calculations: For T(n)

CIRCUIT DIAGRAM

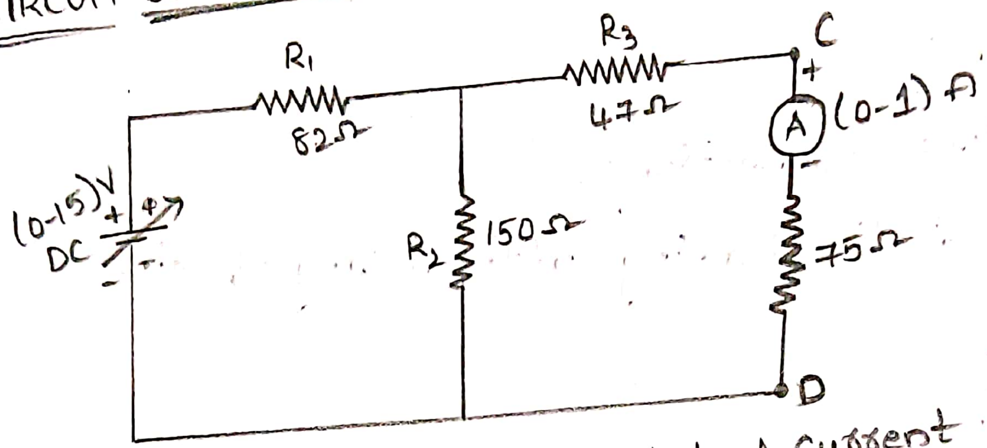

fig 1: circuit diagram to find load current

Procedure to find out V_{Th}:

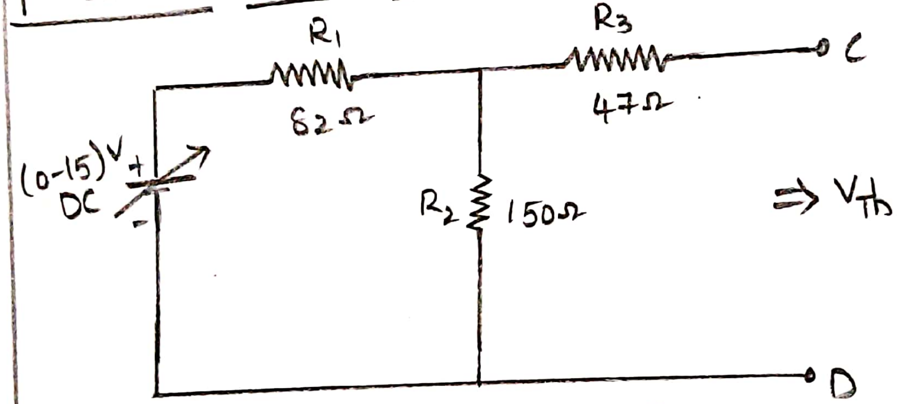

fig 2: circuit diagram to find thevenins voltage (V_{Th})

Procedure to find out R_{Th}

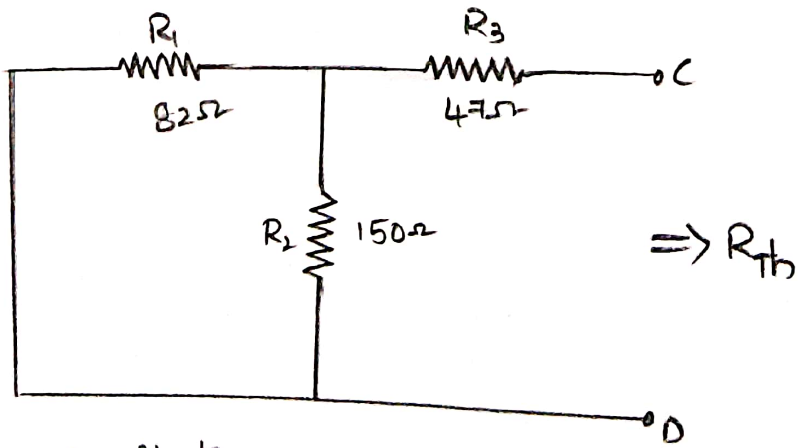

fig 3: circuit diagram to find thevenin's Resistance (R_{Th})

Date :

Experiment No. Sheet No. 11

VERIFICATION OF THEVENINS THEOREM

Aim: To verify the Thevenin's theorem Analytically and practically.

Apparatus:

S.NO	Name of the Equipment	Range	Type	Quatity
1.	Thevenin's theorem kit	-	-	1
2.	Regulated power supply	(0-15)V	Digital	1
3	Digital Ammeter	(0-1)mA	Digital	1
4.	Digital voltmeter	(0-20)V	Digital	1
5	Resistor	82Ω, 47Ω, 150Ω, 75Ω	-	4
6.	Connecting wires.	-	-	As required

Theory:

It states that in any lumped, linear network having more no. of sources & elements the equivalent circuit across any branch can be replaced by an equivalent circuit consisting of thevenin's equivalent voltage source V_{th} in series with Theremin's equivalent

Procedure to find out load current (I_L)

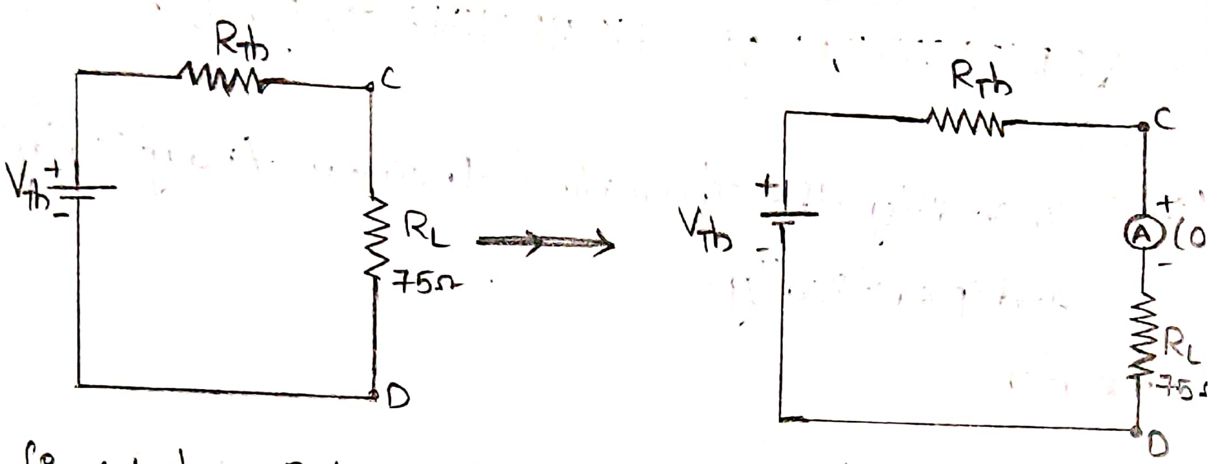

fig 4: thevenin's equivalent circuit to find out load current.

Observations:

	Practical	Theoretical
V	10 V	10 V
V_{Th}	6.46 V	6.45 V
R_{Th}	99.9 Ω	100.01 Ω
I_L	0.039 A	0.037 A

Resistance R_{th}. where V_{th} is open circuit voltage across the (branch) the two terminals & R_{th} is the resistance seen from the same two terminals by replacing all other sources with internal resistances.

Thevenin's theorem:

the values of V_{th} and R_{th} are determined as mentioned in thevenin's theorem. once the thevenin's equivalent circuit is obtained, then current through any load resistance RL connected across AB is given by,

$$I = \frac{V_{th}}{R_{th}+R_L}.$$

thevenin's theorem is applied to d.c circuits as stated below.

Any network having terminals A and B can be replaced by a single source of e.m.f. V_{th} in series with a source resistance R_{th}.

(i) the e.m.f the voltage obtained across the terminals A and B with load, if any removed i.e., it is open circuited voltage between terminals A and B.

(ii) The resistance R_{th} is the resistance of the network measured between the terminals A and B with load removed and sources of emf replaced by their

Calculations:

Step 1: Remove the load Resistance to calculate the V_{Th}

$\Rightarrow R_{eq} = R_1 + R_2$

$R_{eq} = 82 + 150 \Rightarrow \boxed{R_{eq} = 232\,\Omega}$

$I = \frac{V}{R_{eq}} = \frac{10}{232} = 0.043\ A \Rightarrow \boxed{I = 0.043\ A}$

$V_{Th} = IR_2 \Rightarrow V_{Th} = 0.043 \times 150 = 6.45\ V$

$\boxed{V_{Th} = 6.45\ V}$

Step 2: Replace the voltage source with short circuit to find R_{Th}

$R_{Th} = \cancel{\frac{R_1 \times R_2}{R_1 + R_2} + R_3}$

$R_{Th} = \cancel{\frac{82 \times 150}{82 + 150} + 47}$

$\boxed{R_{Th} = 100.01\ \Omega}$

Step 3: Draw the thevenin's equivalence circuit diagram and connect load resistance to find I_L.

$I_L = \frac{V_{Th}}{R_{Th} + R_L} = \frac{6.45}{100.01 + 75}$

$\boxed{I_L = 0.037\ A}$

internal resistances. Ideal voltage sources are replaced with short circuits & ideal current ~~ars~~ sources are replaced with open circuits.

To find V_{th} the load resistor 'RL' is disconnected, then

$$V_{Th} = \frac{V}{R_1+R_2} \times R_3$$

To find R_{Th} : $R_{Th} = R_2 + \frac{R_1 R_3}{R_1+R_3}$

Thevenin's theorem is also called as "Helmoltz theorem".

Procedure:

To find out V_{th} :-

1. Connect the circuit as shown in fig. 2
2. Apply 20V DC supply between terminal A&B.
3. Measure to the open circuit voltage (V_{oc}) by Connecting the voltmeter across the terminals C&D.

To find out R_{th}:

1. Short circuit the terminal A&B as shown in figure 3.
2. Apply 20V DC supply across the terminals C&D and measure the current.
3. Find out the R_{Th} from the above data by using the formula $R_{Th} = V/I$.

Date :

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To find out Load current (I_L):-

1. Connect the circuit as shown in figure 4.
2. Include the load resistance to the thevenin's equivalent circuit.
3. Measure the current flowing through the load resistance & verify the thevenin's theorem.

Result:

thevenin's theorem verified practically and theoretically.

V good

~~Iterations~~, For I(A)

Circuit diagram:

Measuring current through the load directly.

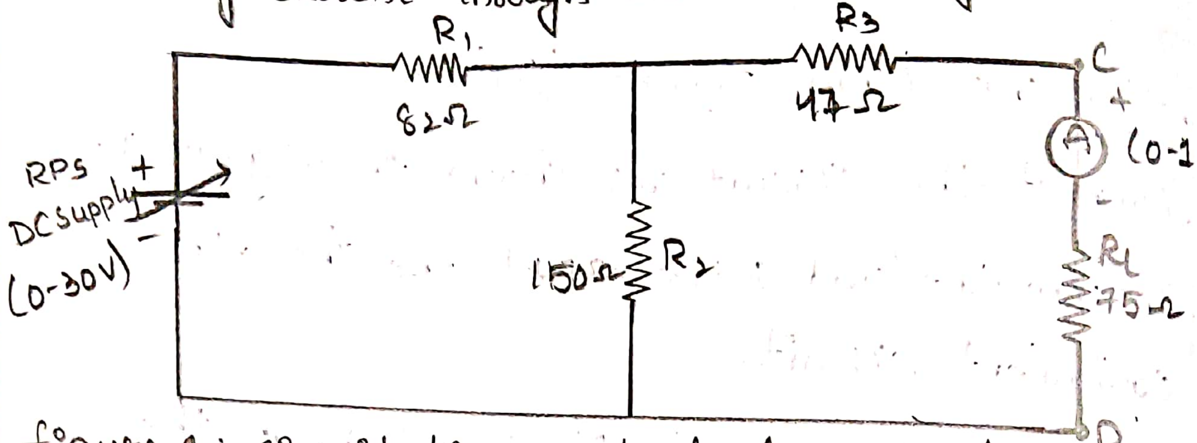


figure 1: circuit diagram to find out load current

Procedure to find out I_N:

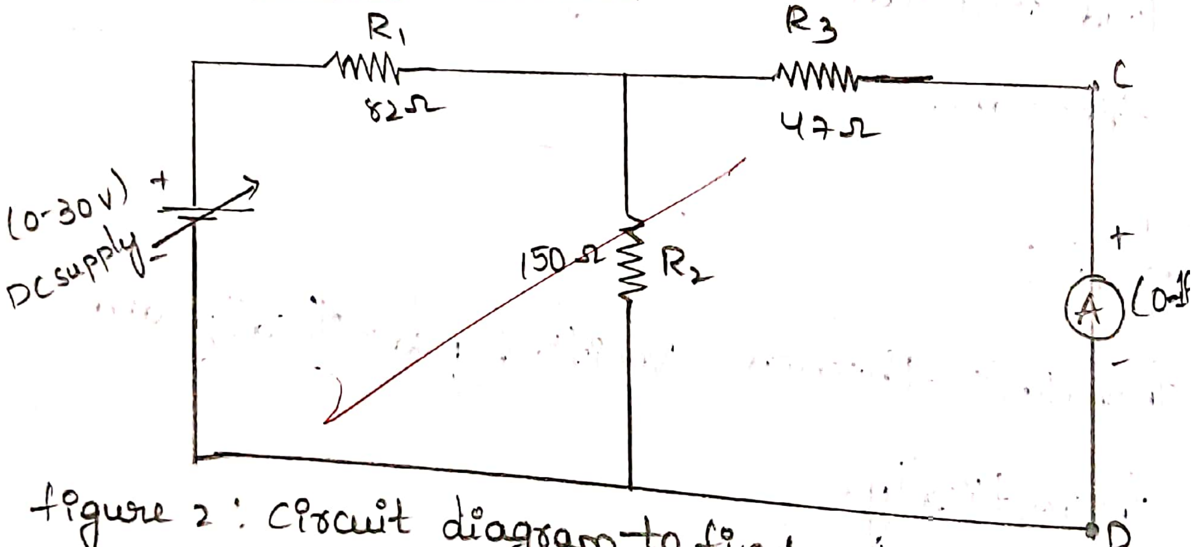


figure 2: circuit diagram to find out Norton's curr

Procedure to find out R_N:

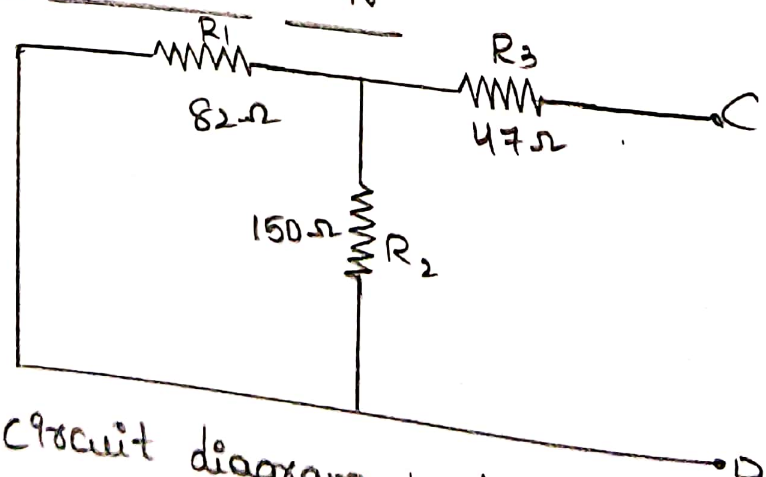


figure 3: circuit diagram to find out Resistance

Date :

Experiment No.

Sheet No. 15

VERIFICATION OF NORTON'S THEOREM

Aim: To verify the Norton's theorem Analytically and practically.

Apparatus:

S.NO	Name of the Equipment	Range	Type	Quantity
1.	Norton's theorem kit	-	-	1 NO
2	Regulated power Supply	(0-15)V	Digital	1
3	Digital Ammeter	(0-1)A	Digital	2
4.	Digital voltmeter	(0-20)V	Digital	2
5.	Resistor	82Ω, 47Ω, 150Ω, 75Ω	-	4.
6.	Connecting wires	-	-	As required

Theory: NORTON'S THEOREM

Norton's theorem states that in a lumped linear network the equivalent circuit across any branch is replaced with a current source in parallel a resistance where the current is the Norton's current which is

VERIFICATION OF NORTON'S THEOREM

Aim: To verify the Norton's theorem Analytically and practically.

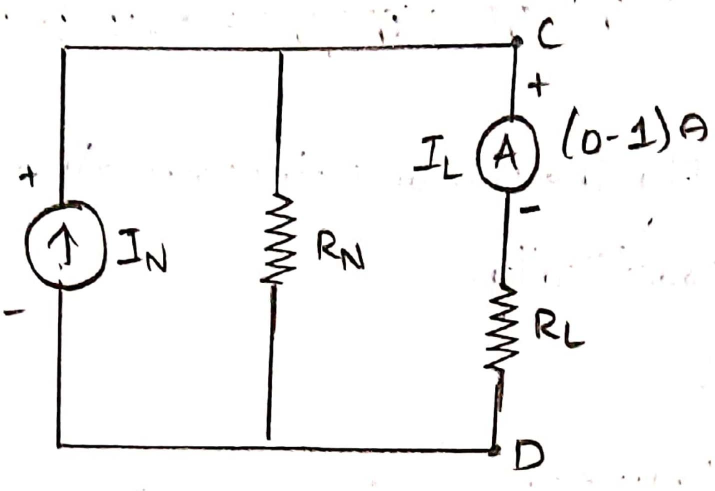
Apparatus:

S.NO	Name of the Equipment	Range	Type	Quantity
1.	Norton's theorem kit	-	-	1 NO
2	Regulated power Supply	(0-15)V	Digital	1
3	Digital Ammeter	(0-1)A	Digital	2
4.	Digital voltmeter	(0-20)V	Digital	2
5.	Resistor	82Ω, 47Ω, 150Ω, 75Ω	-	4.
6.	Connecting wires	-	-	As required

Theory: NORTON'S THEOREM

Norton's theorem states that in a lumped linear network the equivalent circuit across any branch is replaced with a current source in parallel a resistance where the current is the Norton's current which is

Procedure to find out Load current (I_L)



observations:

	V_s	I_{sc}	R_N	$I_L = I_N\left(\frac{R_N}{R_N+R_L}\right)$
theoretical	10V	0.065 A	100.01 Ω	0.038 A
practical	10V	0.069 A	100 Ω	0.038 A

Calculations:

step 1: Remove the load resistance, replace wit short circuit.

$$R_{eq} = \frac{R_2 R_3}{R_2+R_3} + R$$

$$R_{eq} = \frac{150 \times 47}{150+47} + 82$$

$$\boxed{R_{eq} = 117.78\ \Omega}$$

$$I = \frac{V}{R} = \frac{10}{117.78} = 0.085\ A$$

the short circuit current through that branch and the resistance is the Norton's resistance which is the equivalent resistance across that branch by replacing all the sources with their internal resistances.

for Sources current,

$$I = \frac{V}{R'} = \frac{V(R_2+R_3)}{R_1R_2+R_1R_3+R_2R_3}$$

For Norton's current

$$I_N = I_L \times \frac{R_3}{R_3+R_2}$$

Load current through Load Resistor

$$I_L = I_N \times \left[R_N/(R_N+R_L)\right]$$

Procedure:

To find out I_N:

1. Connect the circuit as shown in figure 2.
2. Apply 20V DC supply between terminals A & B.
3. Ammeter across C and D terminals is used to measure the Norton's current.

To find out R_N:

1. Short circuit terminals A and B as shown in fig 7.
2. Apply 20V DC supply across terminal C and D measure the current.

Step 2: Find I_N value

$$I_N = I_{SC} = I_T \times \frac{R_2}{R_2+R_3}$$

$$= 0.085 \times \frac{150}{150+47}$$

$$\boxed{I_N = 0.065 \text{ A}}$$

Step 3: Remove the voltage source replace with short circuit

$$R_N = \frac{R_1 R_2}{R_1+R_2} + R_3$$

$$R_N = \frac{82 \times 150}{82+150} + 47$$

$$\boxed{R_N = 100.01 \, \Omega}$$

Step 4: Draw equivalent circuit to find load current.

$$I_L = I_N \frac{R_N}{R_N+R_L}$$

$$= 0.065 \times \frac{100.01}{100.01+75}$$

$$\boxed{I_L = 0.038 \text{ A}}$$

3. Find out the R_N from the above data by using the formula $R_N = V/I$.

To find out Load Current (I_L)

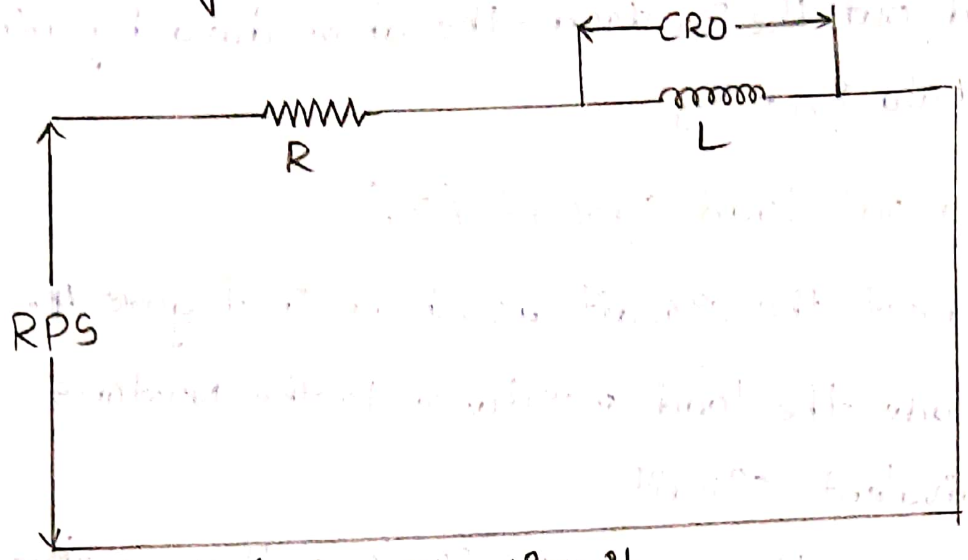
1. Connect the circuit as shown in figure 4.
2. Include the load resistance to the Norton's equivalent circuit.
3. Measure the current flowing through the load resistance and verify the Norton's theorem.

Result:

Norton's theorem verified practically and Theoretically.

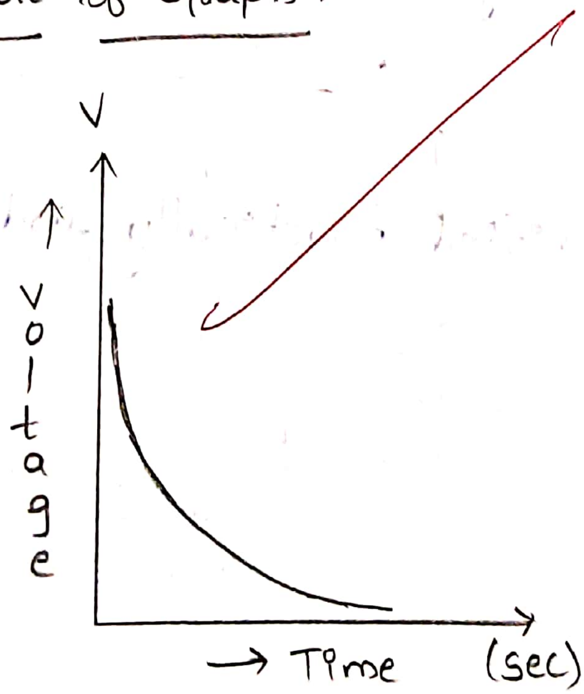
V. good

Circuit diagram:



Series RL Circuit

Nature of Graph:



Series RL circuit Graph

Date :

Experiment No. Sheet No. 18

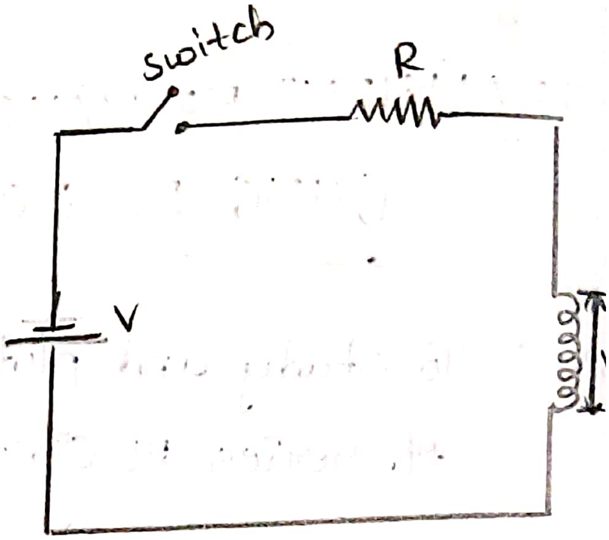
TRANSIENT RESPONSE OF SERIES RL CIRCUIT USING DC EXCITATION

Aim: To study and plot the transient response of series RL Circuit.

Apparatus:

S.NO	Name of the Equipments	Range	Type	Quantity
1.	Trasient response of series RL circuit kit	-	Digital	1.
2.	CRO	-	Digital	1.
3	Connecting wires	-	-	As required

Derivation of RL Circuit



Applying KVL,

$$L\frac{di}{dt} + i(t) = R.V$$

$$V - i(t)R \Rightarrow \frac{dt}{L} = \frac{di(t)}{V-i(t)R}$$

'$\int$' on B.S

$$\int_0^t \frac{dt}{L} = \int_0^t \frac{di(t)}{V-i(t)R}$$

$$= \left[\frac{t}{L}\right]_0^t = \left[\log(V-i(t)R)\right]_0^t$$

$$\frac{t}{L} = \left[\frac{\log(V-i(t)R)}{0-R}\right]_0^t$$

$$\frac{t}{L} = \left\{\frac{\log(V-i(t)R)}{-R} - \frac{\log V - i(0)R}{R}\right\}$$

$$\frac{-Rt}{L} = \log(V-i(t)R) - \log V$$

$$\frac{-R}{L}t = \log(V-i(t)R) - \log V$$

$$-\frac{R}{L}t = \frac{\log(V-i(t)R)}{\log V} = e^{-\frac{R}{L}t} = \frac{V-i(t)R}{V}$$

$$Ve^{-\frac{R}{L}t} = V - i(t)R$$

$$\Rightarrow -i(t)R = -V + Ve^{-\frac{R}{L}t}$$

$$i(t) = \frac{V}{R}\left(1 - e^{-\frac{R}{L}t}\right)$$

Theory :

Consider a Simple RL Circuit in which resistor, R. and Inductor, L. are Connected in series with a voltage supply of V volts. let us think the current flowing in the circuit is I (amp) & current through resistor & inductor is I_R and I_L respectively. Since both resistance & inductor are Connected in series, so the current in both the elements and the circuit remains the same. i.e $I_R = I_L = I$. Let V_R & V_L be the voltage drop across resistor & inductor.

The impedence of series RL circuit opposes the flow of alternating current. The impedance of series RL circuit is nothing but the Combine effect of resistance [R] & inductive reactance (X_L) of the circuit as a whole. The impedence Z in ohms is given by, $Z = (R^2 + X_L^2)^{0.5}$ & from right angle triangle, phase angle $\theta = \tan^{-1}(X_L/R)$.

In series RL circuit, the values of frequency f, Voltage V, resistance R & inductance L are known & there is no instrument for directly measuring the value of inductance

Voltage across resistor:

$$V_R(t) = i(t)R \Rightarrow \frac{V}{\cancel{R}}\left(1-e^{-\frac{R}{L}t}\right)\cancel{R}$$

$$V_R(t) = V\left(1-e^{-\frac{R}{L}i(t)}\right)$$

Voltage across inductor:

$$V_L(t) = L.\frac{di(t)}{dt}$$

$$= \frac{L}{dt}\frac{V}{R}\left(1-e^{-\frac{R}{L}t}\right)$$

$$= \frac{LV}{R}\left[\frac{1-e^{-\frac{R}{L}t})}{dt}\right]$$

$$= \frac{\cancel{L}V}{\cancel{R}}\left[0-e^{-\frac{R}{L}t}\right]\frac{\cancel{R}}{\cancel{L}})$$

$$= V_L(t) = V\left[e^{-\frac{R}{L}t}\right]$$

at time $t = 0$

$i(t) = 0$

$V_R(t) = 0$

$V_L(t) = 0$

at time $t = \infty$

$i(t) = V/R$

$V_R(t) = V$

$V_L(t) = 0$

at time $t = \frac{L}{R}$

$$i(t) = \frac{V}{R}\left[1-e^{-1}\right] = \frac{V}{R}\left[1-0.368\ R\right]$$

$$= \frac{V}{R}\left[0.632\right]$$

$$V_R(t) = V\left[1-e^{-1}\right] = V\left[0.632\right]$$

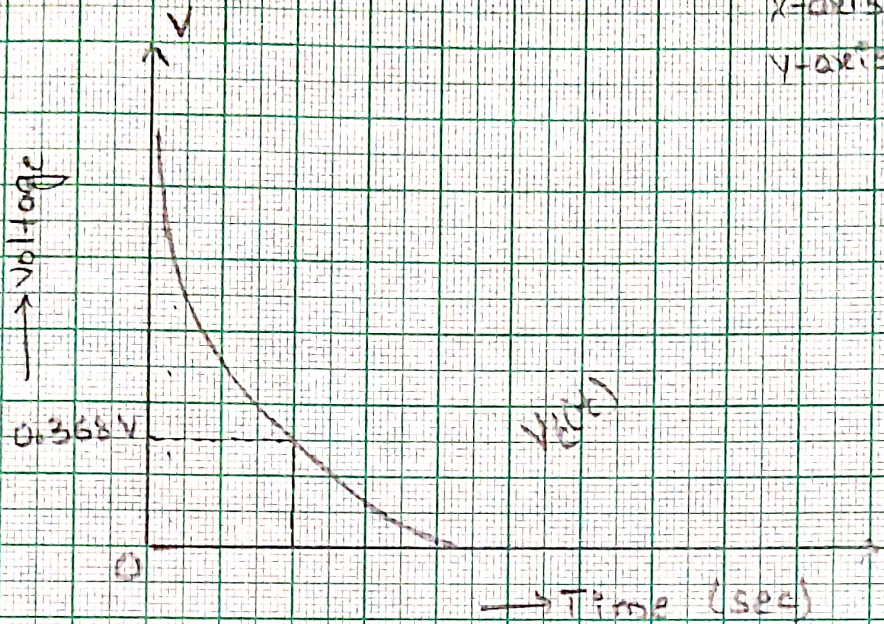
$$V_L(t) = V\left[e^{-1}\right] = V\left[0.368\right]$$

Series RL circuit

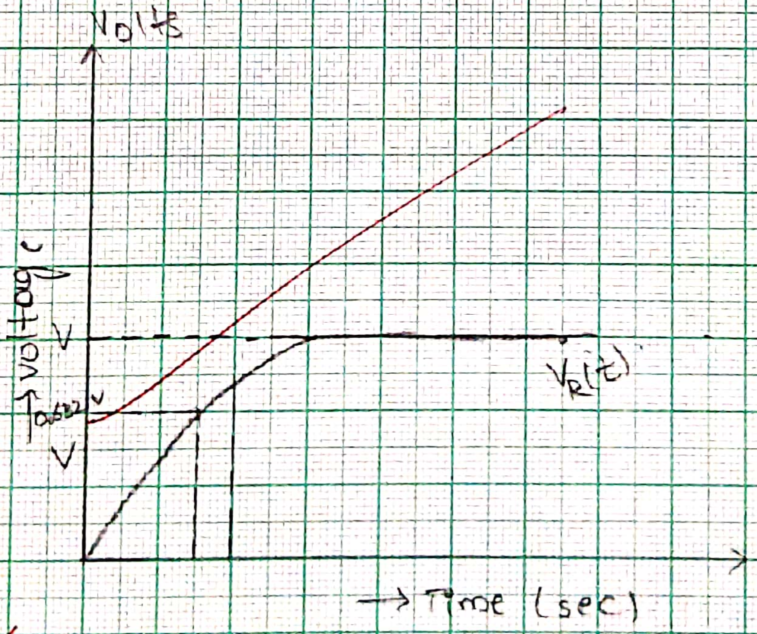
Scale

X-axis 1unit = [illegible] sec

Y-axis 1unit = 0.[illegible] volts



Series RC circuit



V. good

reactance & impedance ; so, for Complete analysis of series RL circuit follow these simple steps.

Step 1: Since the value of frequency & inductor are known, so firstly calculate the value of inductive reactance X_L : $X_L = 2\pi f L$ ohms.

Step 2: From the value of X_L & R, Calculate the total impedance of the circuit which is given by

$Z \sqrt{R^2 + X_L^2}$

Step 3: calculate the total phase angle for the circuit $\theta = \tan^{-1}(X_L/R)$

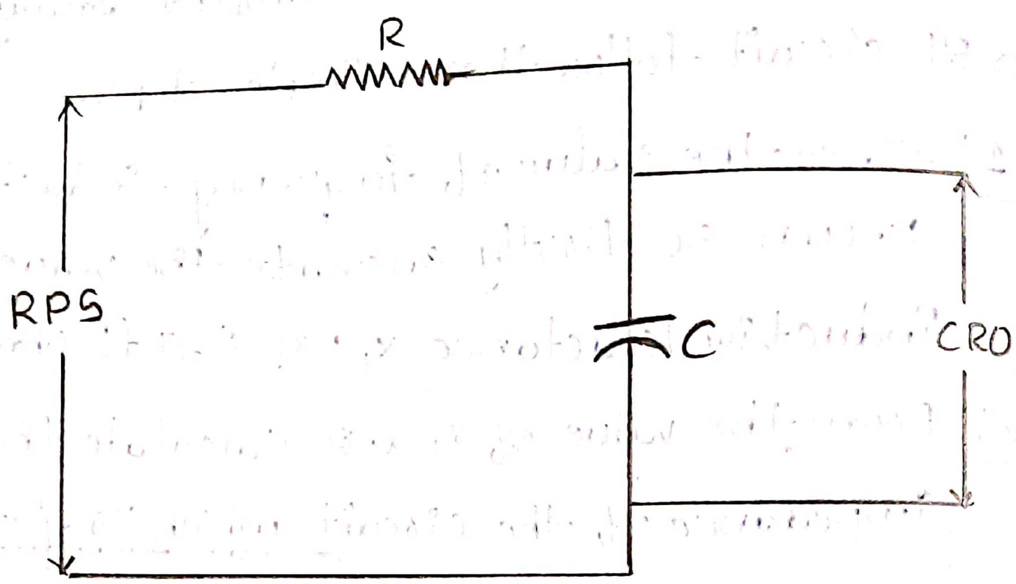
Procedure:

1. Connect the circuit as per circuit diagram.
2. Apply DC supply to the circuit.
3. Observe the current, note down reading
4. plot the Graph.

Result:

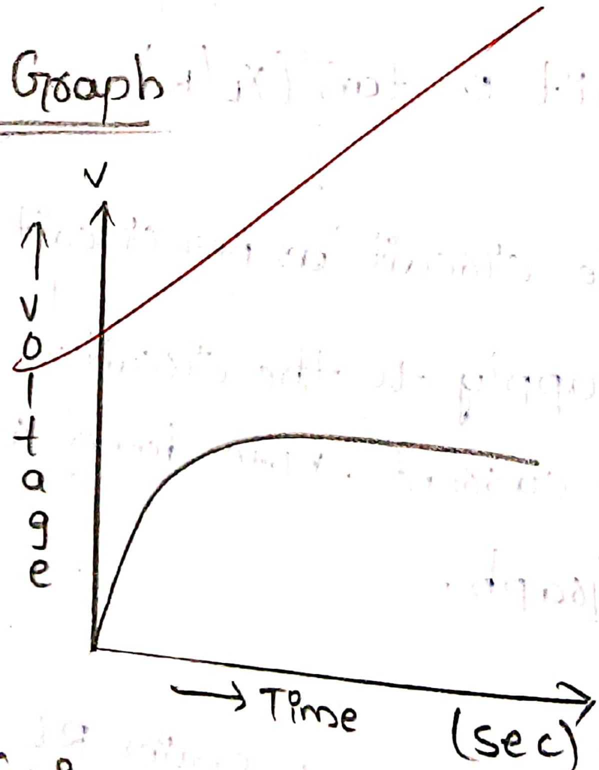
Transient Response of series RL Circuit is Studied.

CIRCUIT DIAGRAM



Series RC Circuit

Nature of Graph



Series RC Circuit Graph

Date :

Experiment No. Sheet No. 21

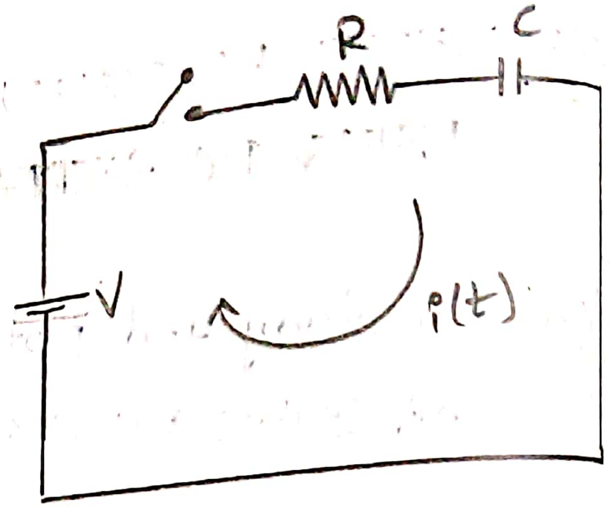
TRANSIENT RESPONSE OF SERIES RC CIRCUIT USING DC EXCITATION

Aim: To study and plot the transient response of series RC circuit.

Apparatus:

S.NO	Name of the Equipment	Range	Type	Quantity
1.	Transient response of series RC circuit kit.		Digital	1.
2.	Ammeter	-	-	1
3	CRO	-	Digital	1.
4	Connecting wires	-	-	As req.

<u>Derivation of RC Circuit</u>



Applying KVL

$$V - i(t)R - \frac{1}{C}\int i(t)\,dt = 0$$

$$i(t)R = \frac{1}{C}\int i(t)\,dt = 0$$

$$V = i(t)R - \frac{1}{C}\int i(t)\,dt$$

D.w.r.t on B.S

$$= \frac{di(t)}{dt}R + \frac{i(t)}{C}$$

Integrating on BS

$$\int_0^t \frac{di(t)}{dt} = \frac{-1}{RC}\int_0^t dt \Rightarrow \log[i(t)]_0^t = \frac{-1}{RC}[t]_0^t$$

$$\log[i(t)]_0^t = \frac{-1}{RC}\int_0^t dt$$

$$\log[i(t)] - \log i(0) = \frac{-1}{RC}t \qquad \left[i(0) = \frac{V}{R}\right]$$

$$\log i(t) - \log\frac{V}{R} = \frac{-1}{RC}t$$

$$\log\left[\frac{i(t)}{V/R}\right] = \frac{-1}{RC}t$$

$$\frac{i(t)}{V/R} = e^{-\frac{1}{RC}t}$$

$$\boxed{i(t) = \frac{V}{R}e^{-\frac{1}{RC}t}}$$

Voltage across Resistor, $V_R(t) = I.R$

$$V_R = i(t)R$$

$$V_R(t) = \frac{V}{\cancel{R}}e^{-\frac{1}{RC}t}.\cancel{R}$$

$$\boxed{V_R(t) = Ve^{-\frac{1}{RC}t}}$$

Date :

Experiment No.

Sheet No. 22

Theory:

The following steps are used to draw the phasor diagram of RC series circuit.

1. Take the current I (r.m.s value) as a reference vector.
2. Voltage drop in indresistance $V_R = IR$ is taken in phase with the current vector.
3. Voltage drop in current leads voltage by 90° in pure capacitive circuit.
4. The vector sum of the two voltage drops is equal to the applied voltage V (r.m.s value)

Now, $V_R = I_R$ & $V_c = IX_C$ where, $X_C = I/2\pi fc$.

$2\sqrt{R^2 + X_C^2}$

Voltage across capacitor : $V_c(t) = \frac{1}{C}\int_0^t i(t)\,dt$

$$= \frac{1}{C}\int_0^t \frac{V}{R} e^{-\frac{1}{RC}t}$$

$$= \frac{V}{RC}\left[e^{-\frac{1}{RC}t} \right]_0^t - \int_0^t \frac{1}{RC} t\, dt$$

$$= \frac{V}{RC}\left[\frac{e^{-\frac{1}{RC}t}}{-1/RC} - \frac{e^{-1/RC(0)}}{-1/RC(t)} \right]$$

$$= \frac{V}{RC}\left(\frac{e^{-\frac{1}{RC}t}}{-1/RC} + \frac{1}{1/RC} \right] = \frac{V}{\cancel{RC}}\left[\frac{1 - e^{-\frac{1}{RC}(t)}}{1/\cancel{RC}} \right]$$

$$V_c(t) = V\{1 - e^{-\frac{1}{RC}t}]$$

at $t = 0$

$i(t) = \frac{V}{R}(e)$

$i(t) = \frac{V}{R}$

$V_R(t) = V$

$V_c(t) = 0$

at $t = \infty$

$i(t) = \frac{V}{R}\{e^{-\infty}]$

$i(t) = 0$

$V_R(t) = 0$

$V_c(t) = V$

at $t = RC$

$$i(t) = \frac{V}{R}\left[e^{-\frac{1}{\cancel{RC}}(\cancel{RC})} \right] = \frac{V}{R}[e^{-1}]$$

$$i(t) = \frac{V}{R}[0.368]$$

$$V_R(t) = V[0.368]$$

$$V_c(t) = V[1 - 0.368]$$

$$V_c(t) = 0.632\,V.$$

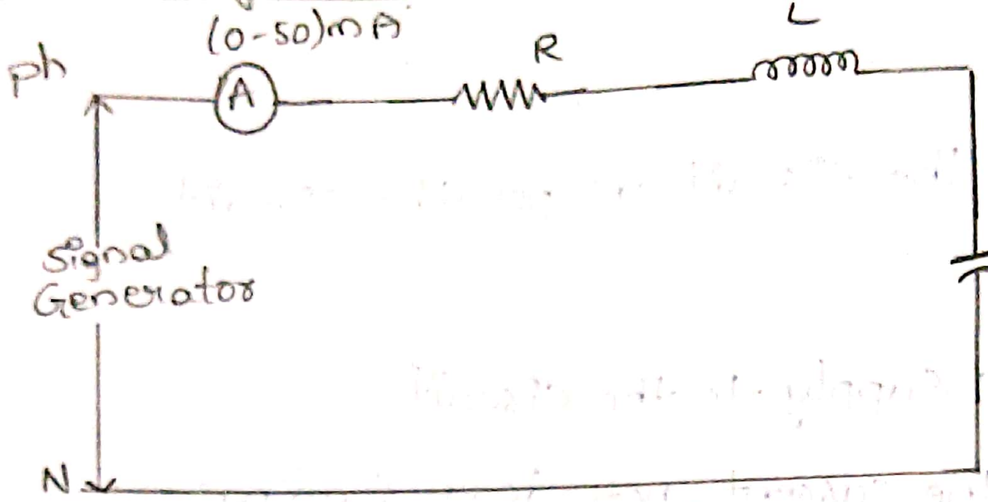
Procedure:

1. Connect the circuit as per the circuit diagram.
2. Apply DC supply to the circuit.
3. Observe the current, note down readings.
4. plot the Graph.

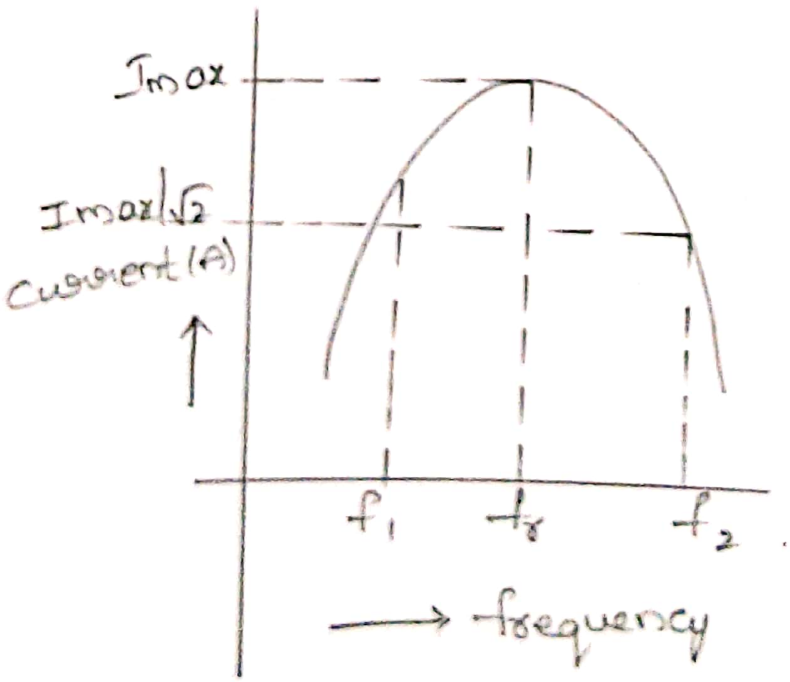
Result:

Transient response of series RC circuit is studied.

Circuit diagram:



Model Graph



Date :

Experiment No.

Sheet No. 24

RLC Series Resonance

Aim: To find the resonant frequency, quality factor, band width of a Series resonant circuit.

Apparatus:

S.NO	Name of the Equipment	Range	Type	Quantity
1.	Function Generator	1MHZ	Digital	1
2.	Ammeter	0-200mA	"	1
3	CRO		"	1
4	Connecting Wires		"	As required

Theory:

The voltage across the inductor is $V_L = IX_L$ then voltage across the Capacitor is $V_C = IX_C$. The voltage across the resistor is $V_R = IR$ phase relations among these voltages are shown in figure 1. The Voltage across the resistor is in phase with the current. The voltage across the inductor leads the Current by 90° degrees. The voltage across the Capacitor lags the current by 90°.

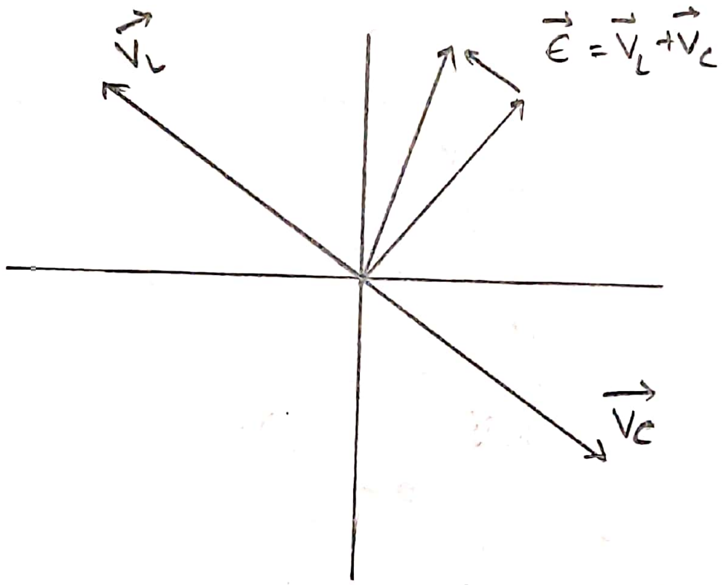
Calculations: [-

observations:

sl.NO	frequency (KHz)	voltage (v)	current I (mA)
1	0.5	2	0.2
2	1	3.7	0.37
3	3	7.1	0.71
4	5	7.3	0.73
5	7	7.5	0.75
6	9	6.2	0.62
7	11	5.2	0.52
8	13	4.5	0.45
9	15	3.3	0.31

The total voltage across the resistor, inductor & Capacitor should be equal to the emf Supplied by the generator.

$$\vec{E} = \vec{V_R} + \vec{V_C} + \vec{V_L}$$



If we divide both sides of this equation by current, $E = \sqrt{V_R^2 + (V_L + V_C)^2}$

$$E/I = Z = R^2 + (X_L - X_C)^2$$

Where $(X_L - X_C)$ is called total reactance and Z is called the impedance of the circuit.

Procedure:

1. Calculate the resonant frequency $f_r = 1/2\pi\sqrt{LC}$ of the network
2. Connect the circuit as per the circuit diagram.

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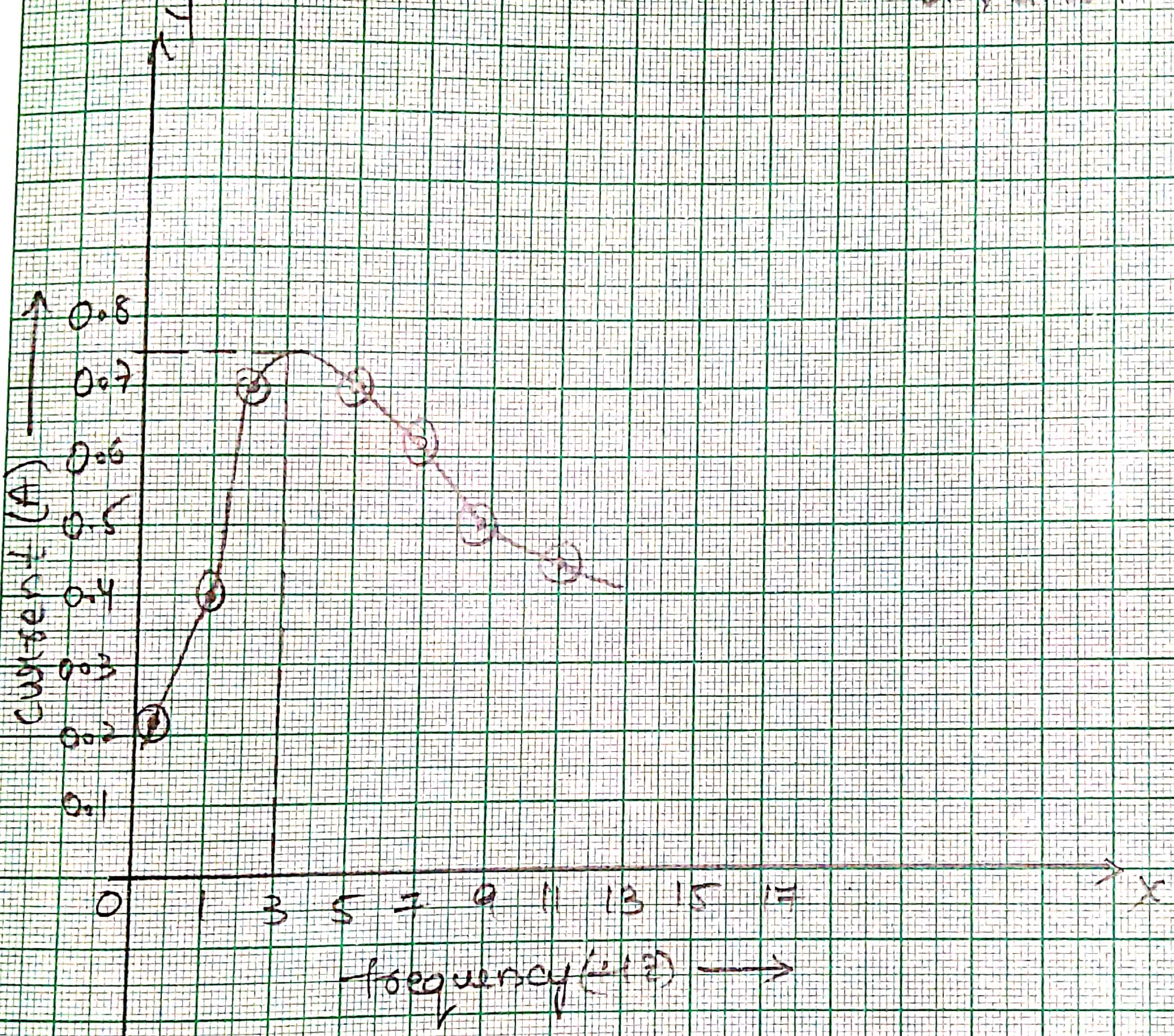
RLC series Resonance

Scale

on X-axis 1 unit = 2 Hz

on Y-axis 1 unit = 0.1 A



3. Vary the frequency of the input signal and note down the current flowing through the circuit
4. Observe the current at resonant frequency
5. Draw the Graph frequency Vs current.

Result:

Resonant frequency of a RLC series Resonance is calculated.

Circuit diagram:

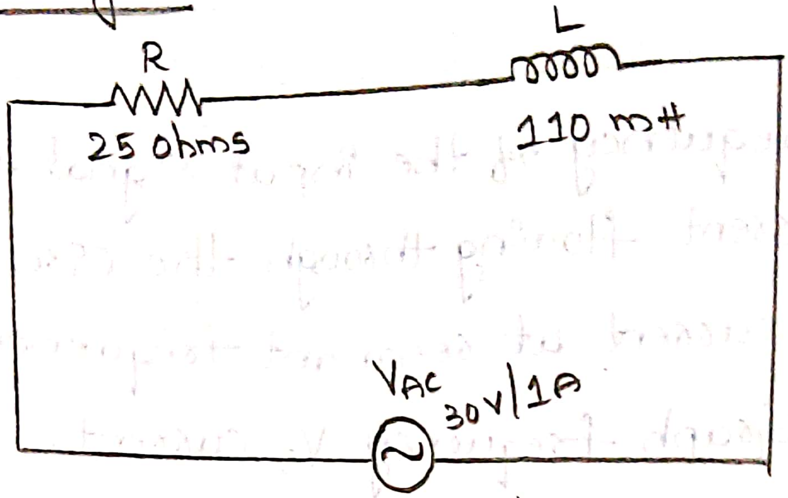


fig 1: RL series circuit.

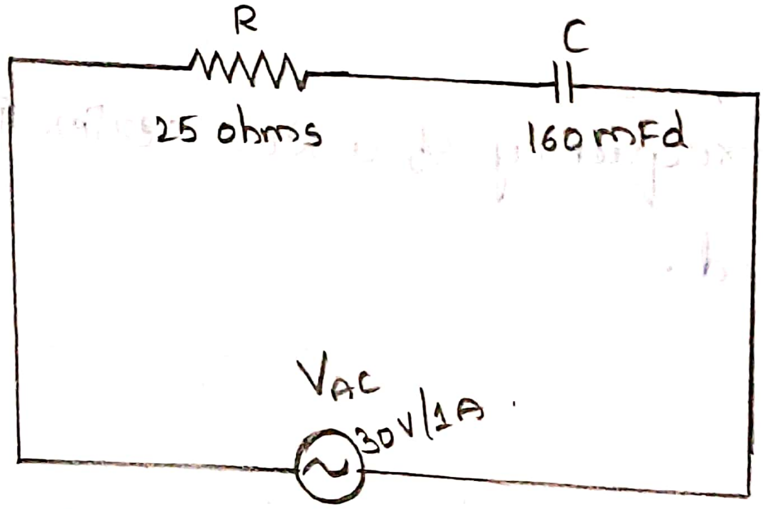


fig 2: RC series circuit.

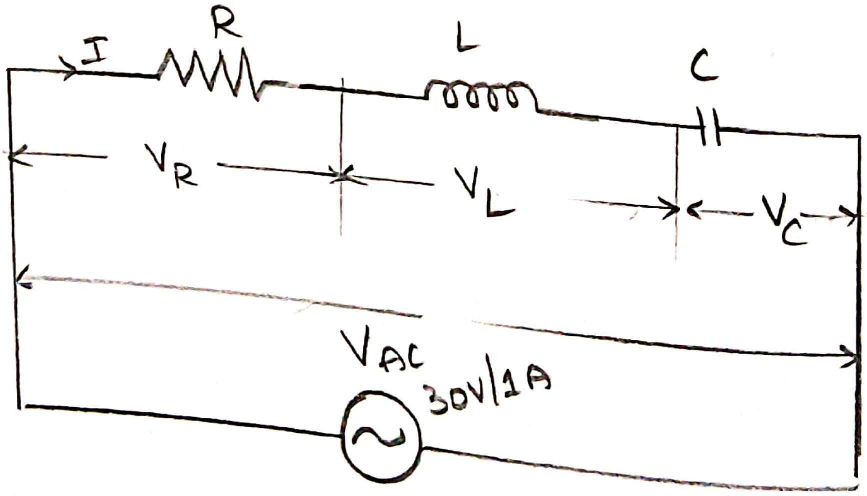


fig 3: RLC series circuit.

Date :

Experiment No.

Sheet No. 27

Verification of Impedence and Current of RL, RC & RLC Series Circuits

Aim: To verify the impedence of RL, RC & RLC series circuits.

Apparatus:

S.NO	Name of Apparatus	Range	Quatity
1.	Resistors	25 Ω	1.
2	Inductors	110 mH	1.
3	Capacitors	----	1.
4	AC power supply source	30V	1.
5	Connecting wires	--	As req.

Theory: Series RL Circuit:

Consider a simple RL circuit in which resistor R & inductor L, are connected in series with a voltage. Supply of 'V' volts. Let us think the current flowing in the circuit is I(Amp) & current through resistor & inductor is I_R & I_L respectively.

	V (volts)	I (A)	Z (ohms)
RL circuits	12V	0.186A	62.8 Ω
RC circuit	12V	0.184A	62.21 Ω
RLC circuit	12V	0.26 A	46.15 Ω

$V = V_m \sin \omega t$

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$X_L = \omega L = 2\pi f L \Rightarrow Z = \sqrt{R^2 + X_L^2}$

$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C} \Rightarrow Z = \sqrt{R^2 + X_C^2}$

RL circuit:

$V = 12\,V$, $I = 0.186\,A$, $Z = \frac{V}{I}$

$Z = \frac{12}{0.186} = 64.5\,\Omega$ (practically)

$R = 30\,\Omega$, $L = 0.2\,H$, $f = 50\,Hz$

$Z = \sqrt{R^2 + X_L^2}$ $\therefore X_L = \omega L = 2\pi f L$

$X_L = 2\pi \times 50 \times 0.2$

$= 62.8$

$Z = \sqrt{(30)^2 + (62.8)^2}$

$Z = 69.8\,\Omega$ (Theoretically)

Since both resistance & inductor are connected in series, so the current in the both elements & the circuit remains the same i.e., $I_R = I_L = I$. Let V_R & V_L be the voltage drop across resistor and inductor.

RC Series Circuit:

The following steps are used to draw the phasor diagram of RC series circuit.

1. Take the current I (r.m.s values) as a reference vector.
2. Voltage drop in resistance $V_R = I_R$ is taken in phase with the current vector.
3. Voltage drop in capacitive reactance $V_C = IX_C$ is drawn 90° behind the current vector as current leads voltage by 90 degree in pure capacitive circuit.
4. The vector sum of the two voltage drops is equal to the applied voltage V (r.m.s value)

Now, $V_R = IR$ & $V_C = IX_C$ where $X_C = \frac{1}{2\pi fC}$

$$Z = \sqrt{R^2 + X_C^2}$$

RLC Series Circuit:

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

Calculations:

RC Circuit :

$R = 30\Omega$, $L = 0.2$ mH, $C = 55 \times 10^{-6}$

$$z = \sqrt{R^2 + X_C^2}$$

$$X_C = \frac{1}{2\pi f C} = \frac{1}{2 \times 3.14 \times 55 \times 10^{-6} \times 50} = 58.32\,\Omega$$

$$z = \sqrt{(30)^2 + (58.32)^2}$$

$$z = 66.028 \quad \text{(Theoretically)}$$

$$z = \frac{V}{I} = \frac{12}{0.184} = 62.21\,\Omega \quad \text{(practically)}$$

RLC circuit:

$$z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$= \sqrt{(30)^2 + (62.5 - 58.3)^2}$$

$$z = 30.26\,\Omega \quad \text{(Theoretically)}$$

$$z = \frac{V}{I} = \frac{12}{0.26} = 46.15 \quad \text{(practically)}$$

Date :

Experiment No.

Sheet No. 29

Procedure:

A. RL Series Circuit:

1. Connect the mains cord to the trainer and switch 'ON' the main supply.
2. Make the connections as per the fig. 1 as shown.
3. Apply same voltage using Variac upto 30V in step wise.
4. Note down all parameters (V & I)
5. Tabulate the Readings.
6. Calculate impedance and current.

B. RC series Circuit:

1. Connect the mains cord to the trainer & switch 'ON' the main supply.
2. Make the connections as per the fig 2. as shown.
3. Apply same voltage using Variac upto 30V in step wise.
4. Note down the parameters (V & I)
5. Tabulate the Readings.
6. Calculate Impedance & current.

Date :

Experiment No.

Sheet No. 30

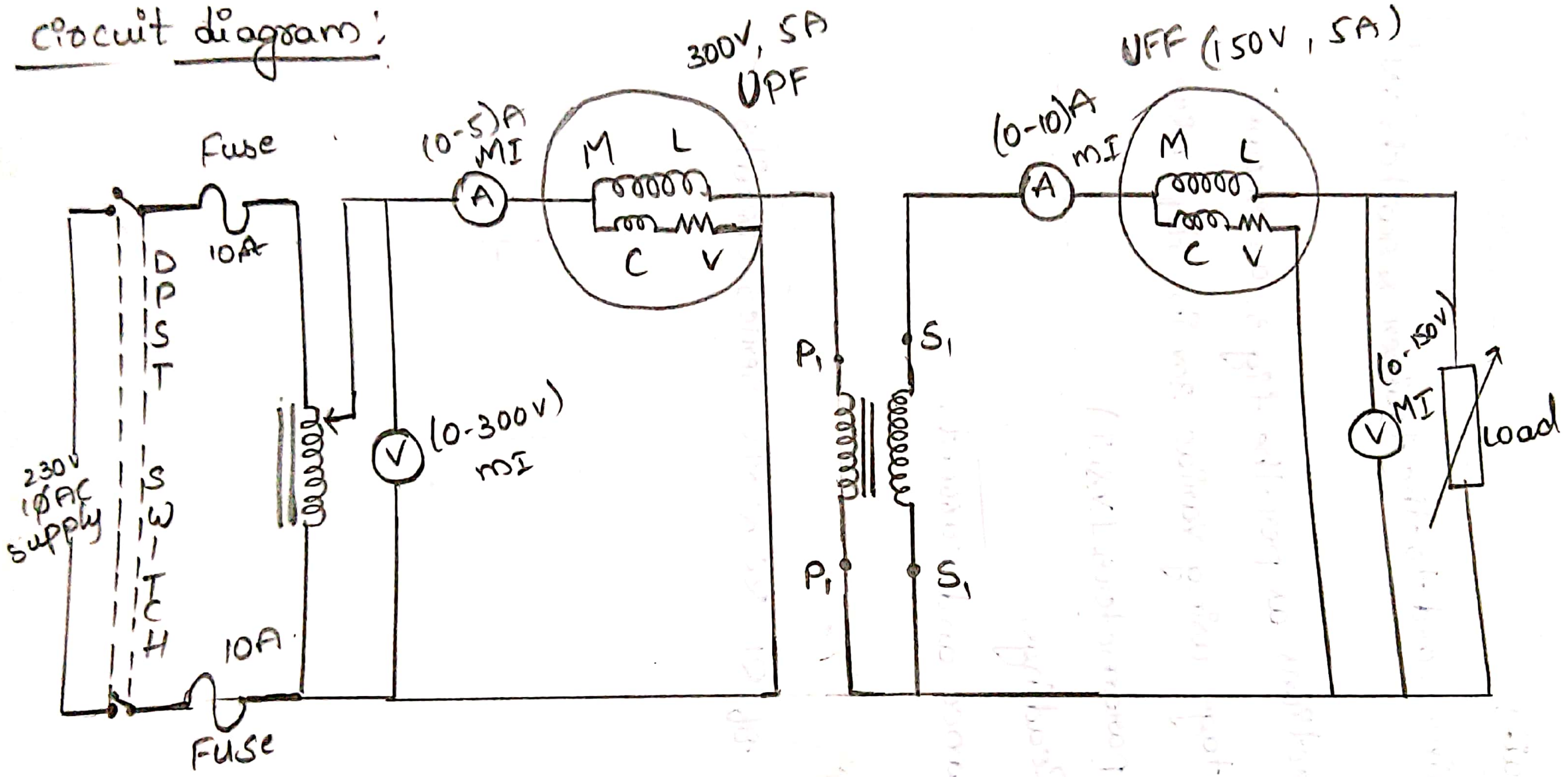
C. RLC Series Circuit:

1. Connect the mains Cord to the trainer & switch 'ON' the Supply.
2. Make the Connections as per the fig-3. as shown
3. Apply Same voltage using Variac 30V in step wise.
4. Note down all parameters (V & I)
5. Tabulate the Readings.
6. Calculate impedance and current.

Result:

The Impedance of RL, RC & RLC Series Circuits are Verified.

Circuit diagram:



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Date :

Experiment No.

Sheet No. 31

Measurement of voltage, current & real power in primary and secondary circuits of a single phase transformer.

Aim: To measure the primary & secondary voltages currents & powers of a single phase transformer.

Apparatus:

S.NO	Equipment	Range	Quantity	(Re) Type
1	1-ϕ transformer	3KVA	1	-
2	Ammeter	(1-10) A (0-5) A	2	MI MI
3	Voltmeter	(0-150)V (0-300)V	2	MI MI
4	Wattmeter	(300V, 5A) (150V, 5A)	2	UPF UPF
5	Auto Transformer	1ϕ, (0-260)V	1	-
6	Resistive load	5kW, 230V	1	-
7	Connecting wires	-	As required	-

observations ;

S.NO	primary			Secondary		
	V_1	I_1	W_1	V_2	I_2	W_2
1	205	1	49.02	105	0	50

Date :

Experiment No.

Sheet No. 32

Procedure:

1. Connections are made as per the circuit diagram.
2. After checking the no load codition, min position of auto transformer & DPST switch is closed.
3. Ammeter, voltmeter & Wattmeter readings on both primary side & Secondary side are noted.
4. The load is increased and for each load voltmeter, Ammeter and Wattmeter readings on both primary and Secondary sides are noted.
5. Again no load Condition is obtained & DPST Switch is opened.

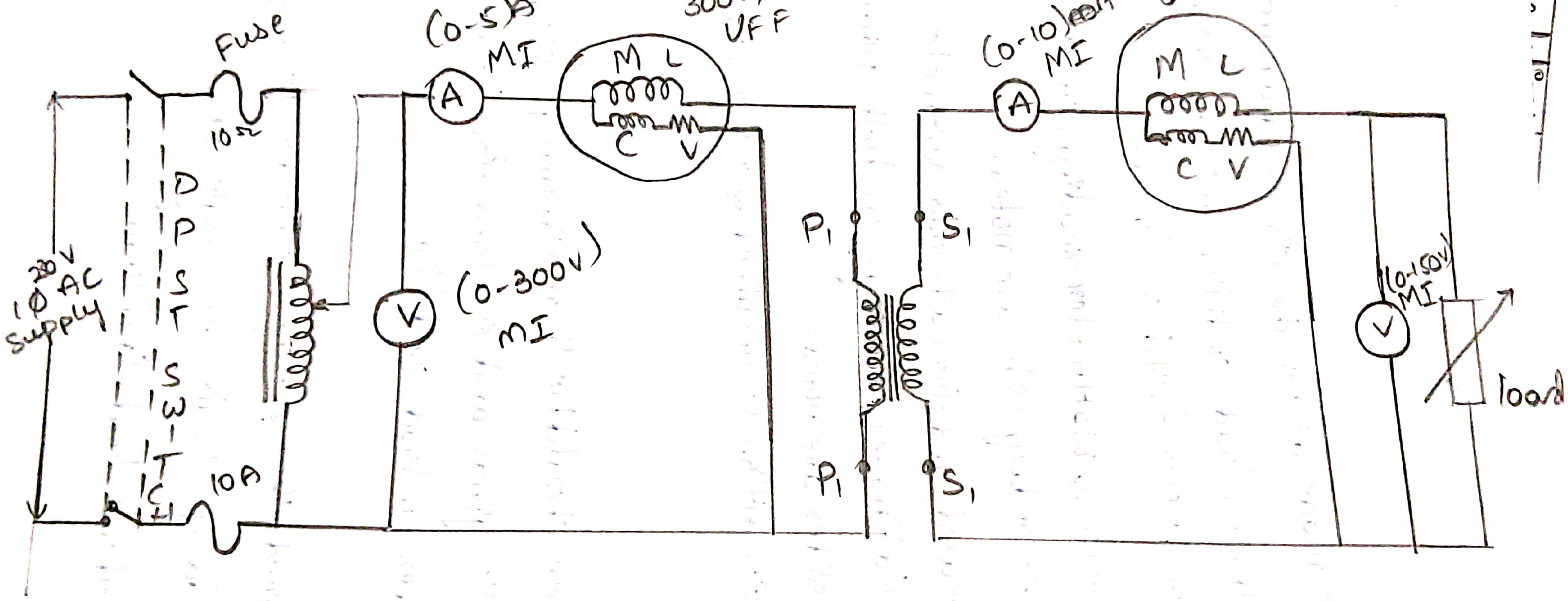
Precautions:

1. Auto Transformer should be in minimum position.
2. The Ac supply is given and removed from the transformer under no load condition.

Result:

We have measured the voltage, current, power of primary & secondary circuits of single phase transformer without load (no load)

Circuit diagram



Date :

Experiment No.

Sheet No. 33

Load test on Single-phase Transformer

Aim: To determine efficiency by load test of a single phase transformer.

Apparatus:

S.NO	Equipment	Range	Quantity	Type
1	1-ϕ Transformer	3KVA	1	-
2	Ammeter	(0-10)A, (0-5)A	2	MI, MI
3	Voltmeter	(0-150)V (0-300)V	2	MI, MI
4	Wattmeter	300V 5A, 150V 5A	2	UPF, UPF
5	Auto transformer	1ϕ, (0-260)V	1	-
6	Resistive load	5KW, 230V	1	-
7	Connecting wires	-	As required	-

Theory:

In a practical transformer there are 2 types of losses (1) cu loss, (2) core / Iron loss.

Therefore, output of a transformer is always less than input of the transformer. Here transformer is loaded with a variable resistive load. Input to

observation:

S.NO	primary			secondary			efficiency
	V_1	I_1	W_1	V_2	I_2	W_2	
1	203	1.5	208	104	4	206	92.8%
2	202	2.3	440	102	7	420	95.45%
3	202	3.1	600	101	10.6	560	93.33%
4	202	3.8	760	100	14	720	94.73%
5	202	4.5	920	99	16.6	840	91.30%

calculations:

1) $\frac{W_2}{W_1} = \frac{260}{280} \times 100 = 92.8\%$

2) $\frac{W_2}{W_1} = \frac{420}{440} \times 100 = 95.45\%$

3) $\frac{W_2}{W_1} = \frac{560}{600} \times 100 = 93.33\%$

4) $\frac{W_2}{W_1} = \frac{720}{760} \times 100 = 94.73\%$

5) $\frac{W_2}{W_1} = \frac{840}{920} \times 100 = 91.30\%$

Load test on 1-ϕ Transformer.

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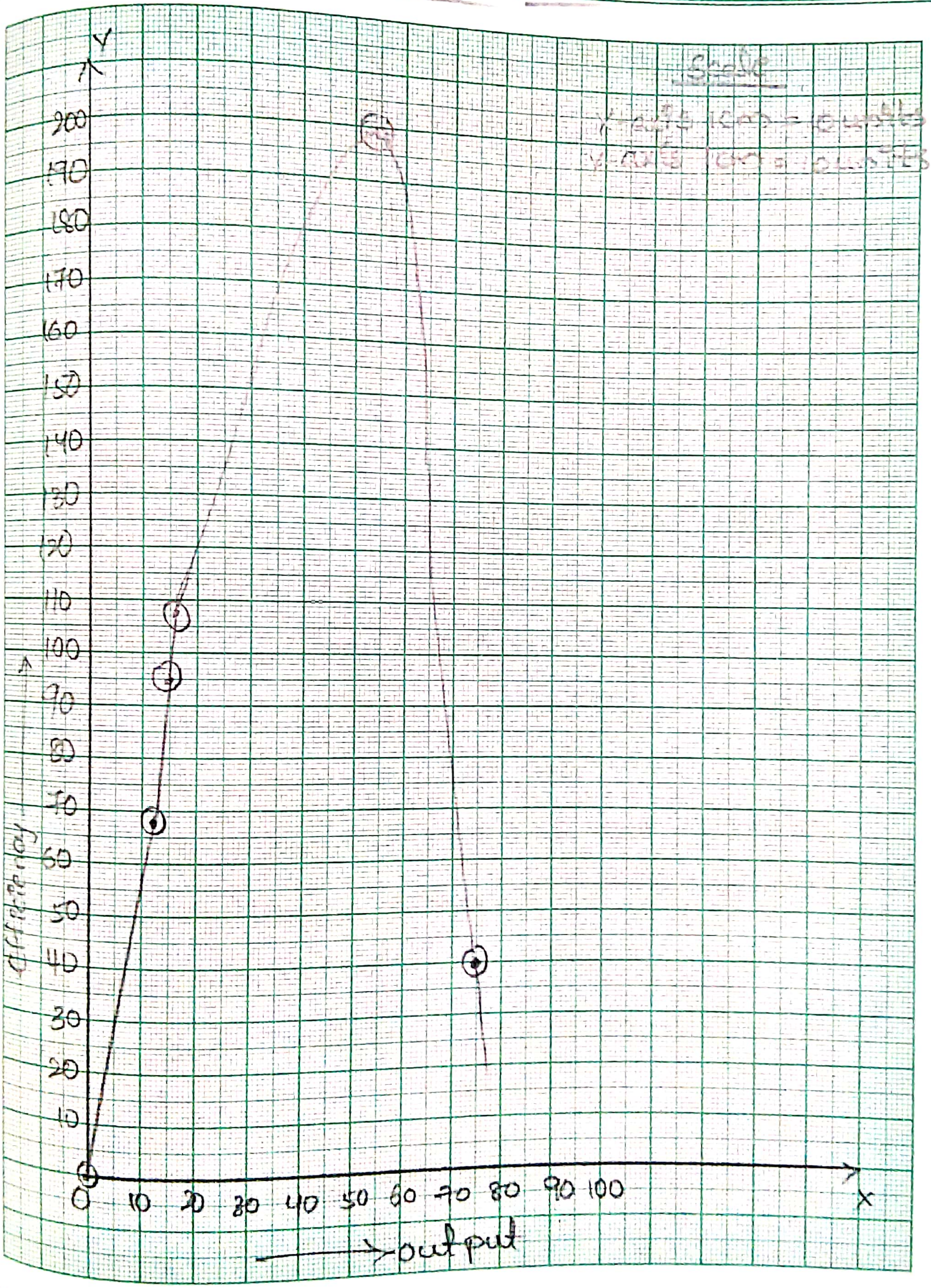


Date :

Experiment No.

Sheet No. 34

the transformer Ca be found out by using a wattmeter & output can also measured wattmeter. Input power of transformer = Reading of wattmeter or $V_1 I_1$

output power of transformer $= V_2 I_2$

% efficiency η = (output power / Input power) x100%.

$= (V_2 I_2 / V_1 I_1) \times 100\%$.

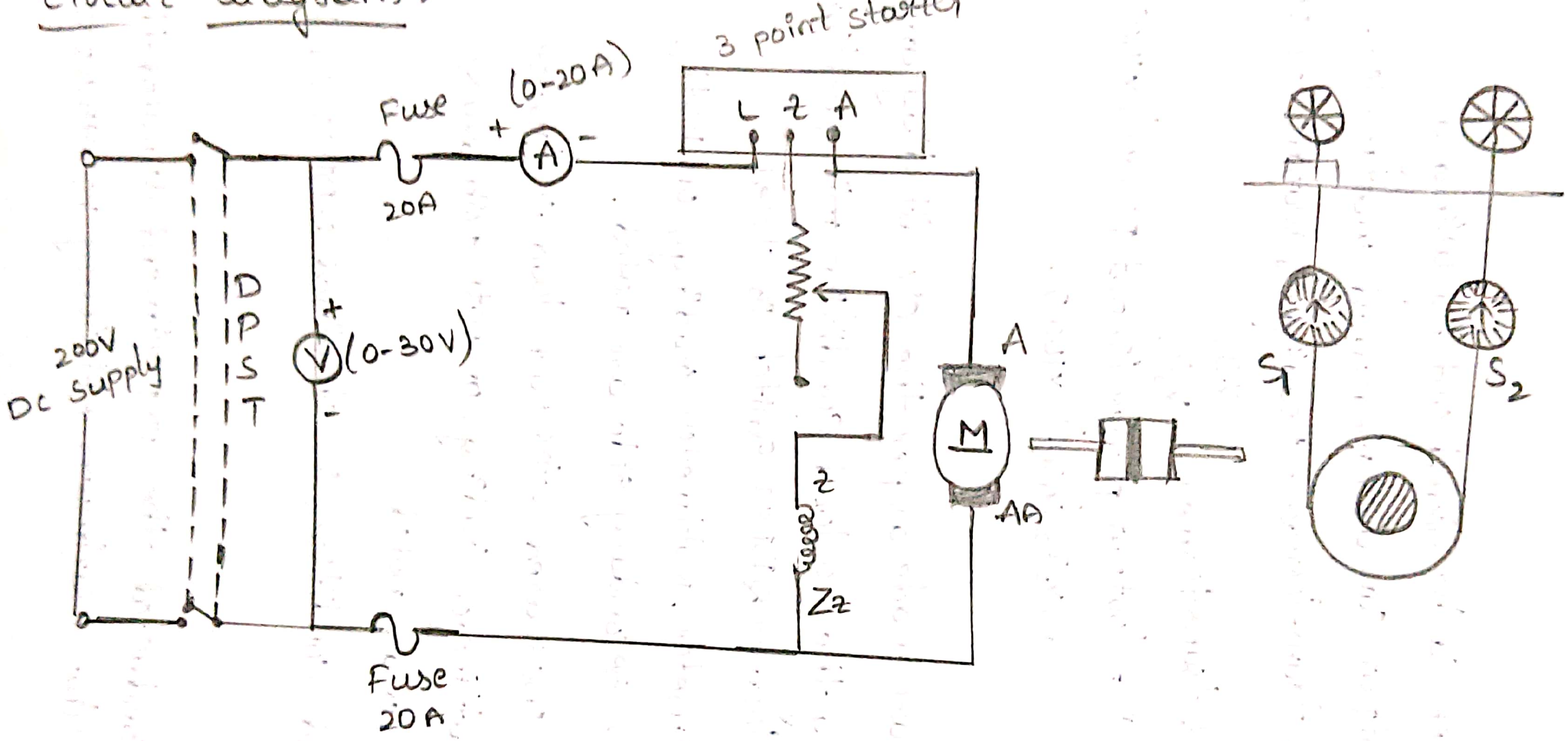
Procedure:

1. Connections are made as per the circuit diagram.
2. After checking the no load condition, min position of auto transformer & DPST switch is closed.
3. Ammeter, Voltmeter, Wattmeter readings on both primary side & secondary side are noted.
4. The load is increased & for each load, voltmeter, Ammeter & Wattmeter readings on both primary & Secondary sides are noted.
5. Again no load condition is obtained & DPST switch is opened.

Result:

We have conducted the experiment & noted the efficiency. The maximum efficiency is 95.45%.

Circuit diagram:



Date :

Experiment No. Sheet No. 35

Performance characteristics of DC shunt motor :

Aim: To obtain the performance characteristics of DC shunt by conducting brake test.

Apparatus:

S.NO	Equipment	Type	Range	Quantity
1.	Ammeter	MC	0-2 A	1
2.	[Thacorme] Tachometer	MC		1
3	Voltmeter	MC	0-300V	1
4	Rheostat	-	0-360 Ω 1.7A	1
5.	Connecting Wires	-	-	As req.

Theory:

It is a direct method & consists of applying a brake to a water cooled pulley mounted on the motor shaft. the brake band is fixed with the help of wooden blocks gripping the pulley. one end of the band is fixed with the to earth via a spring balance S and the other is connected to a suspended weight W. The motor is running & the load on the motor is

Observations:

S.NO	I_L (A)	V_L (V)	S_1 (kg)	S_2 (kg)	$S=S_1-S_2$ (kg)	N (rpm)	T(SR N/m)	$P_0 = 2\pi NT/60$	$P_I = V_L I_L$	$\eta = \frac{P_{o/p}}{P_{i/p}} \times 100$
1	2.2	228	0	0	0	1560	0	0	501.6	0
2	4	228	3	1.5	1.5	1524	2.35	379.7	912	41.6%
3	5	224	5	2.5	2.5	1499	3.92	625.6	1120	58.26%
4	6	224	7	3	4.0	1496	6.27	983.7	1344	73.19%
5	7	224	8	3.5	4.5	1496	7.05	1104.8	1568	70.45%
6	9	220	9	3	6	1486	9.41	1463.5	1980	73.91%
7	11	216	11	2.5	8.5	1478	13.34	2063.6	2376	86.85%

Calculations:

Torque = $S \times R \times g$

R - Radius of drum = 0.16 m

g = gravitational Constant = 9.8 m/s

$T = SRg$

$P_0 = 2\pi NT/60$

$= 2 \times 3.14 \times 1544 \times 2.352/60$

$= 379.7$ W

$P_I = V_L I_L$

$= 228 \times 4$

$= 912$ W

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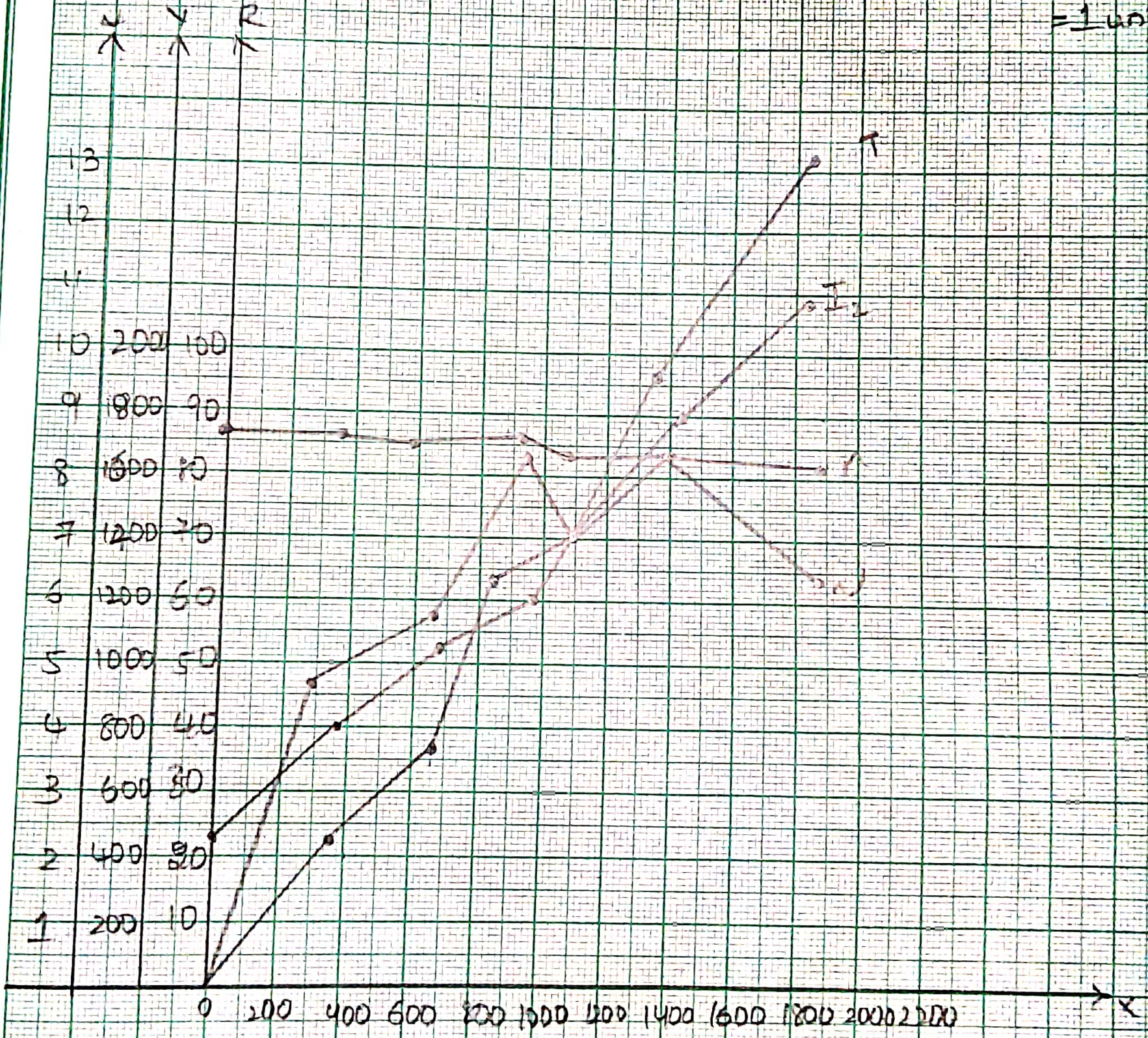
Dc shunt motor

Scale

X-axis 1unit = 200 units
Y-axis 1unit = 10 units
= 200 units
= 1 unit



adjusted till it carries its full load current.

Procedure:

1. Make the connections as shown in the circuit diagram.
2. Keeping the field rheostat (R_f) at the min position switch on the supply & start the motor.
3. Adjust the speed of the motor on no load to its rated value by means of the rheostat. Do not disturb the position of the rheostat. Do not disturb the position of Rheostat throughout the test.
4. Apply the load by tightening the screws of the spring balances. Note down the string tensions, the speed, the voltage & the currents at different full load & is obtained.

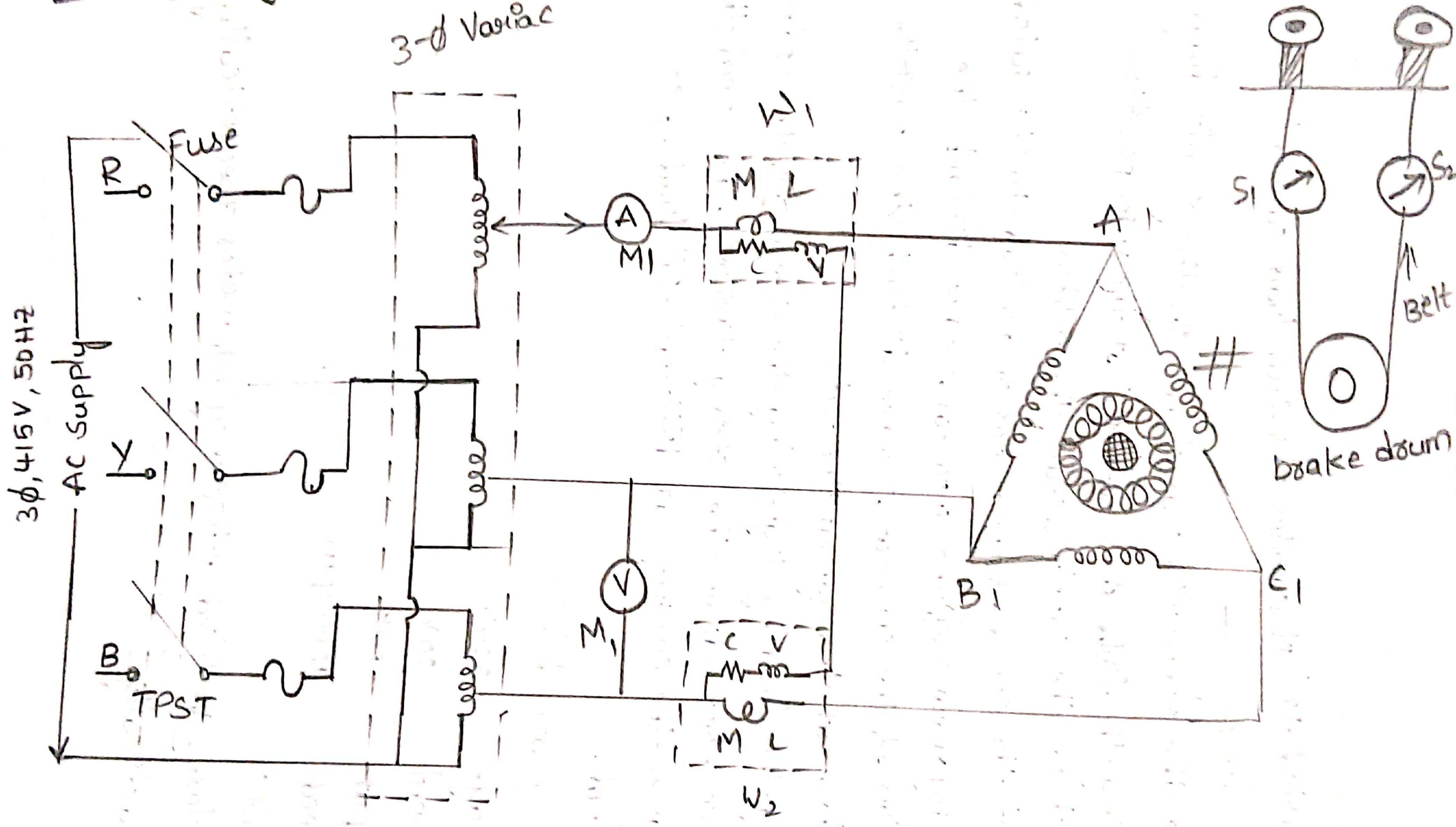
Name plate details.

Voltage	220 V
current	20 V
Output	5 HP
Speed	1500 rpm

Result:

therefore, Verified efficiency of motor theoretically & practically.

Circuit diagram:



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Experiment No.

Sheet No. 37

Measurement of Active & Reactive power in a Balanced 3-phase Circuit.

Aim: To measure three-phase power using two watt meters.

Apparatus:

S.NO	Name	Range	Type	Quantity.
1	voltmeter	0-600 V	MI	1
2	Ammeter	0-10V	MI	1
3	Wattmeter	300V/10A	UAF	2
4	Tachometer	-	Digital	1
5	Connecting wires		-	As req

Theory: **Active power**:

A three phase balanced voltage is applied on a balanced 3ϕ load when the current in each of the phase lags by an load angle ϕ behind corresponding phase voltages. Current through current coil of $W_1 = I_R$, Current through current coil of $W_2 = I_B$, while potential difference across voltage coil of $W_1 = V_{RN} - V_{YN} = V_{RY}$ (line voltage), & the potential difference across voltage coil of W_2 = $V_{RN} - V_{YN} = V_{BY}$. Also, phase difference b/W I_R & V_{RY} is

Calculations

Torque!

1) $T_1 = \gamma(S_1 - S_2) \times 9.81 = 10(0-0) \times 9.81 = 0$ N/m

2) $T_2 = \gamma(S_1 - S_2) \times 9.81 = 10(1-4) \times 9.81 = 294.3$ N/m

3) $T_3 = \gamma(S_1 - S_2) \times 9.81 = 10(1.5 - 6.5) \times 9.81 = -49.05$ N/m

4) $T_4 = \gamma(S_1 - S_2) \times 9.81 = 10(2-9) \times 9.81 = -68.67$ N/m

5) $T_5 = \gamma(S_1 - S_2) \times 9.81 = 10(2-11.5) \times 9.81 = -93.196$ N/m

6) $T_5 = \gamma(S_1 - S_2) \times 9.81 = 10(2.5 - 13.5) \times 9.81 = -107.9$ N/m

Efficiency

$$\eta_1 = \frac{W_2}{W_1} \times 100 = 0.7$$

$$\eta_2 = \frac{W_2}{W_1} \times 100 = \frac{45}{140} \times 100 = 32.14$$

$$\eta_3 = \frac{W_2}{W_1} \times 100 = \frac{21}{160} \times 100 = 13.125$$

$$\eta_4 = \frac{W_2}{W_1} \times 100 = 0,$$

$$\eta_5 = \frac{W_2}{W_1} \times 100 = \frac{19}{200} \times 100 = 9.5$$

$$\eta_6 = \frac{32}{219} \times 100 = 14.61180$$

$(300+\phi)$. while that b/w I_B & V_{BY} is $(300-\phi)$. Thus, reading on wattmeter W_1 is given by $W_1 = V_{RY} I_Y \cos(300+\phi)$ while reading on wattmeter W_2 is given by $W_2 = V_{BY} I_B \cos(300-\phi)$ since the load is balanced.

$|I_R| = |I_Y| = |I_B| = I$ & $|V_{RY}| = |V_{BY}| = V_L$ $W_1 = V_L I \cos(300+\phi)$

$$W_2 = V_L I_L \cos(300-\phi)$$

thus total power P is given by

$$W = W_1 + W_2 = V_L I \cos(300+\phi) + V_L I \cos(300-\phi)$$

$$= V_L I[\cos(300+\phi) + \cos(300-\phi)] = [\sqrt{3}/2 \cdot 2\cos\phi] V_L I_L = \sqrt{3} V_L I \cos\phi$$

Reactive power:

Reactive power measurement in 3-ϕ circuits using 1-ϕ wattmeter can be done only for balanced 3-ϕ loads. By connecting the current coil of the wattmeter in one line & the pressure coil across the other two lines of 3-ϕ circuit, current through the current coil & voltage across the pressure coil are determined. Now as the current in the current coil lags the voltage by an angle of 90°, the wattmeter reads a value proportional to the reactive power of the circuit.

observations:

S.NO	V(volts)	I(A)	watt meter (watt)		spring balance		N(rpm)	Torque $r(S_1-S_2)9.81$ N/m	Input (w) $=(W_1+W_2)$	o/p $=2\pi NT/60$	Efficiency o/p/Ip
			W_1	W_2	S_1	S_2					
1	380	1	115	82	0	0	1490	0	197	0	0.7
2	380	1.5	140	45	1	4	1462	-294.3	185	-45.034	32.14
3	380	2	160	21	1.5	6.5	1450	-49.05	181	-7444.155	13.125
4	380	2.3	188	0	2	9	1454	-68.67	188	-1351.24	0
5	380	2.5	200	19	2	11.5	1452	-93.195	219	-14163.40	9.5
6	380	3	219	32	2.5	13.5	1438	-107.91	251	-1624.604	14.61180

Measurement of Active & Reactive power in a Balanced 3-ϕ circuit

Sheet No. 39

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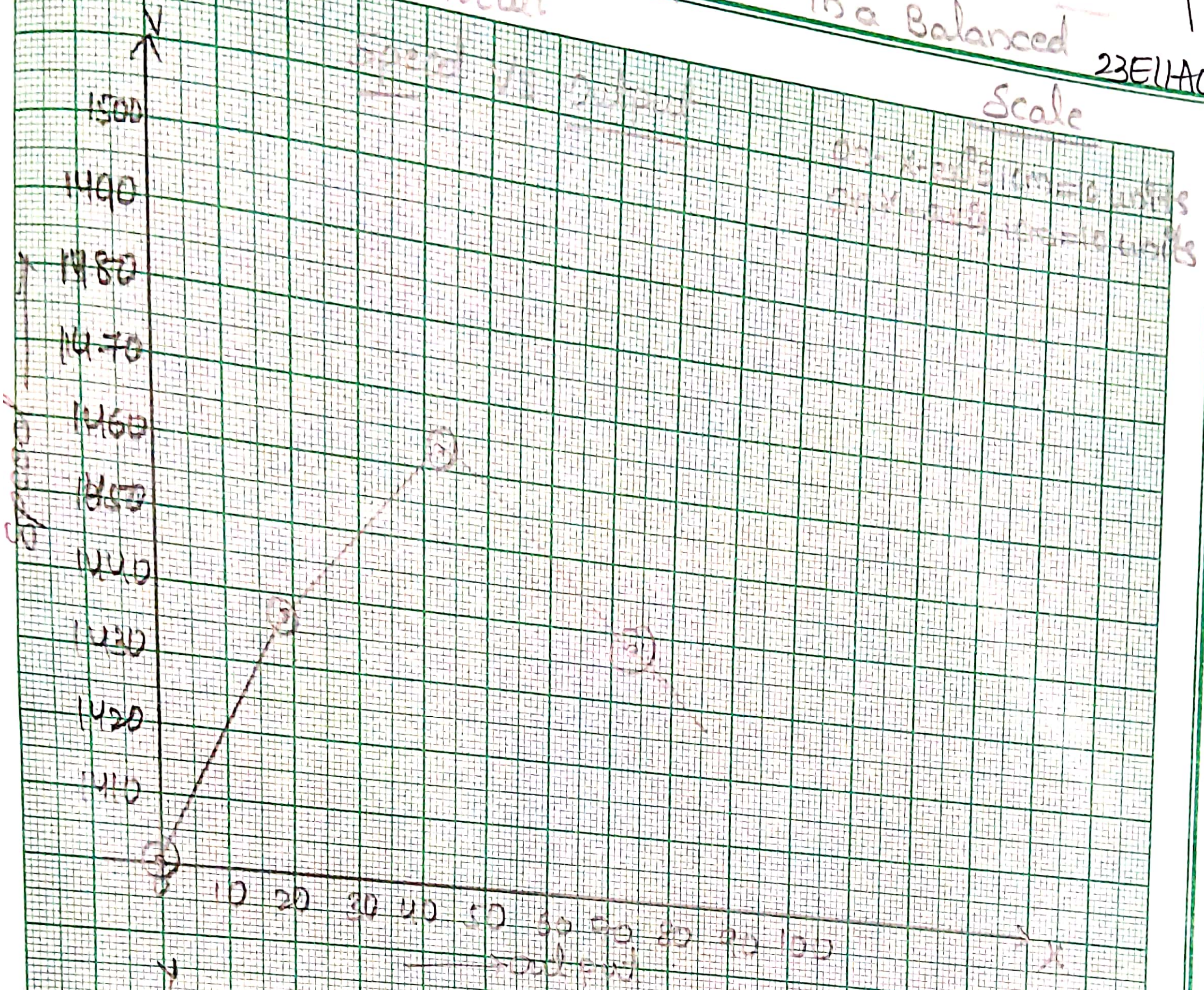

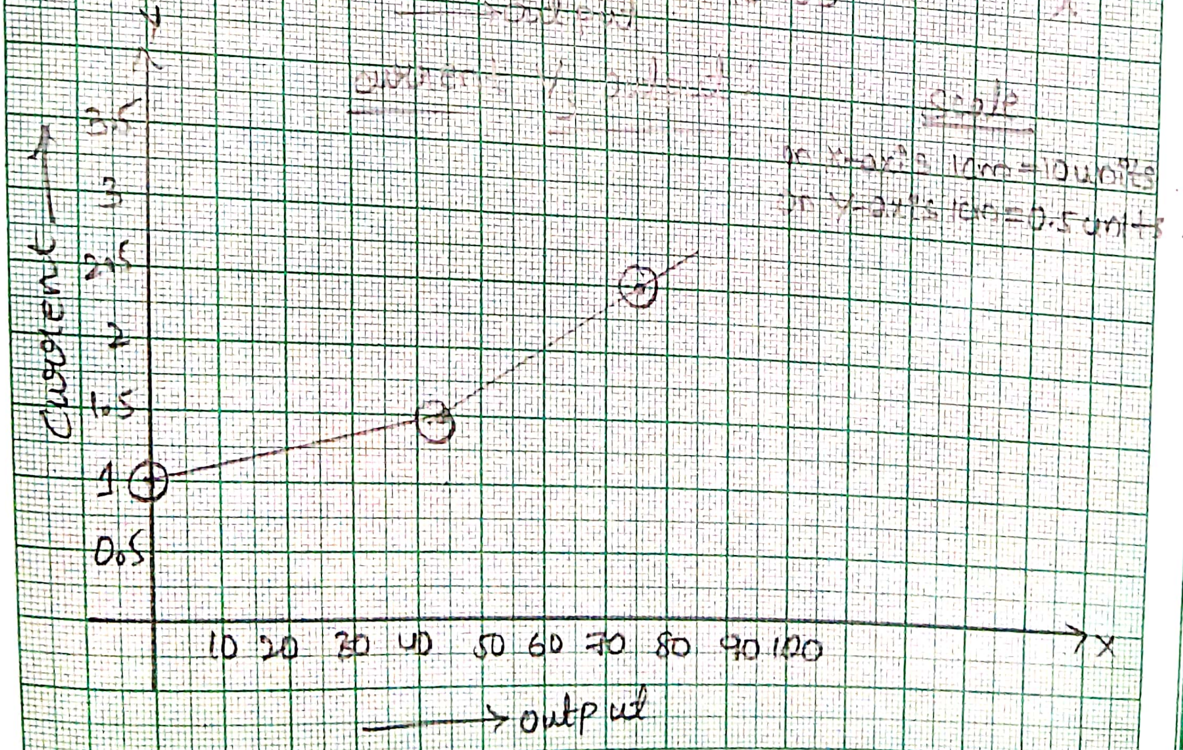

Date :

Experiment No. Sheet No. 39

Procedure:

1. Connect the circuit as shown in figure.
2. Supply switch ON the supply.
3. Apply 415 V & note down the corresponding readings & calculate 3 ϕ reactive power.
4. Now increase the load ~~of~~ the three phase inductive load steps & Note down the corresponding meter readings.
5. Remove the load and switch off the supply.

Result:

Hence, the performance characteristics of the three-phase induction motor is verified theoretically and practically.