Date 23/11/2022

Expt. No. 1 Page No.

Aim:- To Verify Ohm's Law.

Objectives 1. Explain Ohm's law
2. Explain Ohm's law for Resistance in series and parallel.
3. Measure and confirm Ohm's law.
4. Explain non-Ohmic devices.

Explanation of Ohm's Law:

1. The law states that the current through a conductor between two points is directly proportional to the Voltage across the two points such as Conductor is Characterised by its 'Resistance'. R measured in Ohm's.

2. $V = I \times R V = I \times R$
- V is the Voltage in Volts across the Conductor
- I is the current in ampere through the Conductor
- Voltage (V) is directly proportional to current i.e $V = I \times R V = I \times R$

$VR2 = R2 \times IT$

In a series circuit, the current through each of the Resistors is same and the Voltage across the Circuit is the sum of the Voltages across each resistors.

Voltage

$IR2 = VSR2$

In a parallel reading circuit, the voltage across each of the resistors is the same, and the total current is the sum of the Currents through each resistors.

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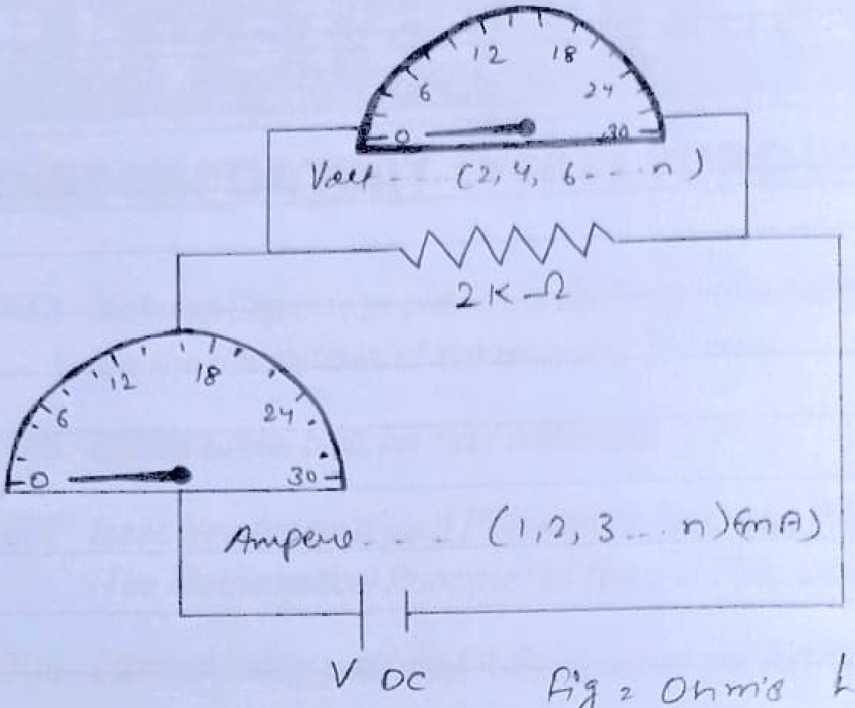

Fig = Ohm's Law

Observation

S.NO.	Voltage (Volt) V	Current (Milli ampere) mA
1.	2	1.00
2.	4	2.00
3.	6	3.00
4.	8	4.00
5.	10	5.00
6.	12	6.00
7.	14	7:00
8.	16	8:00
9.	18	9:00
10.	20	10.00

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Non Ohmic Device :-

A Non Ohmic device is a device that does not obey Ohm's law i.e the resistance is not Constant but Changes in a way that depends on the Voltage across it. The device is said to be non-ohmic. Example of such devices are tungsten filament (bulb), diode

Procedure:

1) Set DC Voltage (0-30V)
2) Set the Resistance Value (1 Kohm- 100 Kohm).
3) Voltmeter is placed parallel to resistor and ammeter series with resistors
4.) Now note the Voltmeter and Ammeter reading for DC Voltage.
5.) Increase the DC Voltage by 2 factor and not Voltmeter and ammeter readings. Keep resistance Value Constant.
6.) Plot the V-I Graph to verify Ohm's law.
7.) Repeat step 2 to 6 for another set of resistance Value.
8.) V versus I graph is a straight line.
9.) Therefore from the graph we see that the resistance also adhere to Ohm's law. Thus resistance is said to be an Ohmic device.

Result :- Ohm's Law Graph has been Verified Graph is linear.

Neetasingh 7/12/22

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Date 22/12/22

Expt. No. 2 Page No.

Experiment Name: Verification of Kirchoff's Current law and Kirchoff's Voltage law.

Objective: 1. To verify Kirchoff's Current law
2. To verify Kirchoff's Voltage law

Theory:

Kirchoff's Current law: The algebraic sum of current at any junction of a system of Conductors is zero, i.e. the sum of the currents flowing into a junction must be equal to the sum of current flowing away from the junction.

Kirchoff's Voltage law: In a closed electric circuit the algebraic sum of potential drops is equal to the algebraic sum of total electromotive force occuring round the circuit.

Procedure:

KCL

1. Connect the circuit in the trainer kit as per the circuit diagram.
2. Adjust the input Voltage by adjuster for different reading.
3. Connect the ammeters to get the respective currents meeting at the required node.
4. Repeat the same procedure for different observation
5. Compare the value with theoretical results.

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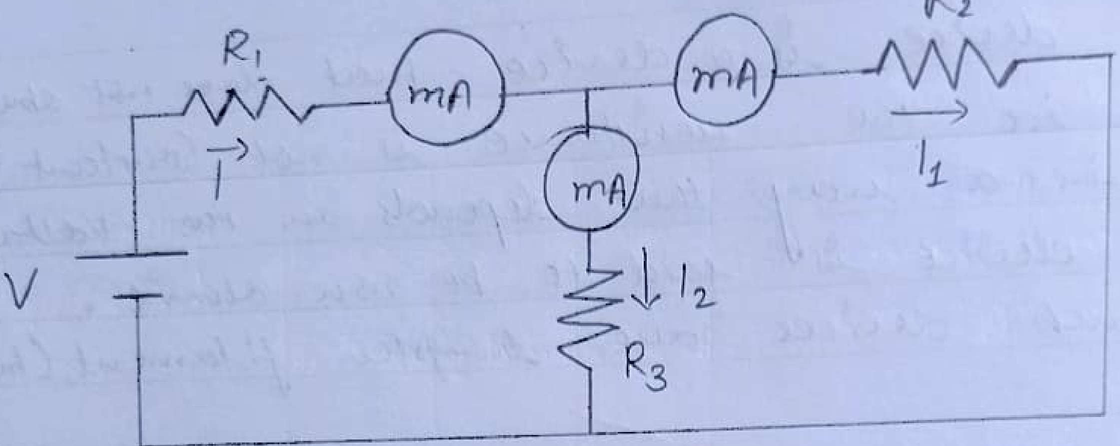
Circuit Diagram



Verification of KCL

Observation Table

Input Voltage Supply (V)	$R = 265\Omega$	$R = 265\Omega$	$R = 470\Omega$	Total I (mA) (measured Value)	Circuit Total Current (mA)
5 V	$I_1 = 18.3mA$	$I_2 = 18.3mA$	$I_3 = 10.4mA$	47 mA	47 mA
10 V	$I_1 = 36.4mA$	$I_2 = 36.6mA$	$I_3 = 20.7mA$	93.7 mA	92.7 mA

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K.V.L

1. Connect the circuit in the trainer kit as per circuit diagram.
2. Adjust the input Voltage by adjuster for different reading.
3. Connect the Voltmeters to get the required Voltage.
4. Repeat the procedure for different observation
5. Compare the Value with theoretical results.

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22/12/22

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Date 22/12/2022

Expt. No. 3

Page No.

Aim:- To verify superposition theorem.

Theory:- If a number of voltage or current source are acting simultaneously in a linear network, the resultant current in any branch is the algebraic sum of the current that would be produced in it, when each source act alone replacing all other independent source by their internal resistance.

Procedure:-

(1) Connect the circuit as shown in diagram, keeping the switches open and resistance at their maximum positions.

(2) Set S_1 to position "aa" and S_2 to position "cc" respectively which means both the sources are energized. Note down the current I_1, I_2 & I_3 from ammeter A_1, A_2 & A_3

(3) Set S_1 to position "aa" and S_2 to position "dd" respectively which means the only 220 V source is energized and the terminal of S_2 are shorted.

(4) Set S_1 to position "bb" & S_2 to position "cc" respectively which means the only 110 V source is energized and the terminals of S_1 are shorted.

(5) Compare I_1, I_2 & I_3 with $I_1'' + I''$, $I_2' + I_2''$ take care of the signs properly.

(6) Repeat the steps 2 to 6 for 5 different value of resistance for each three rheostats.

Apparatus Used

A DC voltage source of 12 Volts, a current source of 100 mA, a DC voltmeter (0-12V), a DC ammeter (0-20mA), three

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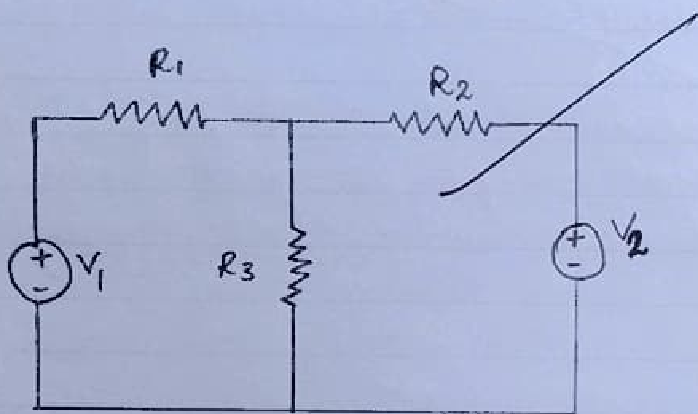
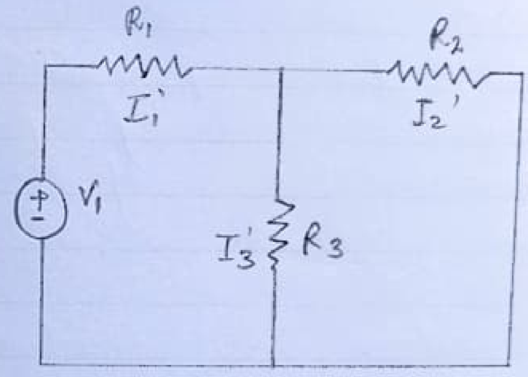
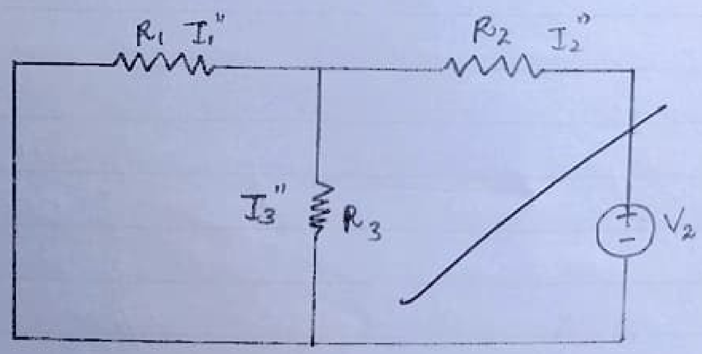
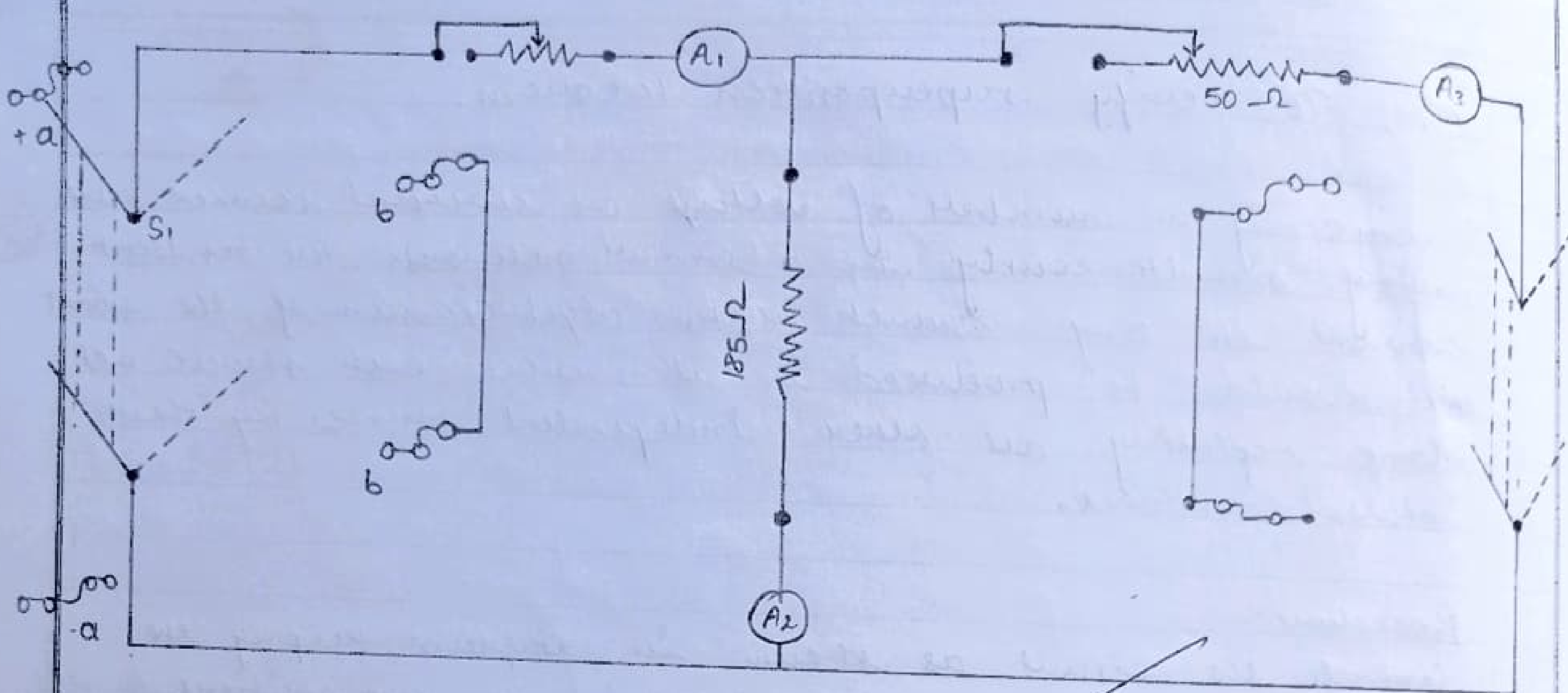
S. NO	In presence of both V_1 & V_2			In presence of V_1			In Presence of V_2		
	I_1(A)	I_2(A)	I_3(A)	I_1 (A)	I_2 (A)	I_3 (A)	I_1 (A)	I_2 (A)	I_3 (A)
1.	0.390	-0.106	0.283	0.567	-0.354	0.212	-0.177	0.248	0.070
2.	0.780	-0.212	0.567	1.135	-0.709	0.425	-0.354	0.495	0.141
3.	0.808	-0.129	0.677	1.290	-0.806	0.483	-0.483	0.677	0.193
4.	0.854	-0.096	0.758	1.419	-0.887	0.552	-0.564	0.790	0.225
5.	0.903	-0.064	0.838	1.548	-0.967	0.580	-0.645	0.903	0.258









+a
S1
b
b
-a
A1
185 Ω
A2
50 Ω
A3

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resistance of 100 Ω each and connecting wires or DC theorem kit having all the above

Conclusion

The observed values and calculated values are nearly same. the different between them is for instrumental and observation error. Neglecting this errors. Superposition theorem is verified successfully.

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Date 22/12/2022

Expt. No. 4 Page No.

Aim:- Verification of Thevenin's Theorem

Theory - A linear and bi-directional two terminal network can be replaced by an equivalent network consisting of a voltage source V_{th} connected series with a resistor R_{th}.

- V_{th} - open circuit voltage / voltage at terminals.
- R_{th} → Input / equivalent resistance at terminals when the independent sources turned off.

Procedure :-

(1) Keep all the resistance close to their maximum respective values.

(2) Close the switch S_1 to "aa" and S_2 to "cc" position observe the load current (I_1) and voltage (V_1) readings.

The load resistance $R_L = \frac{V_L}{I_L}$

(3) Remove the load by opening to switch S_2 and read the open circuit voltage of Thevenin equivalent voltage (V_{th})

(4) Next compute the resistance (R_{th}) of the network as seen from the load terminals.

(a) Replace 220V source by a shunt by closing S_1 to "bb".

(b) Apply 110V at the output terminals by closing S_2 to "dd". Read the voltmeter (V) and ammeter (I) and get

$$\boxed{R_{th} = \frac{V}{I}}$$

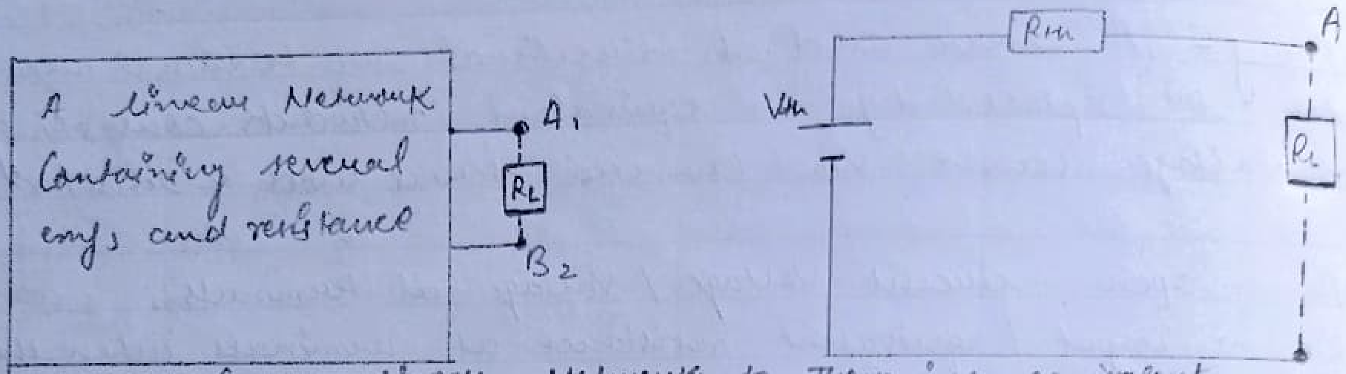
(5) Now compute the load resistance. Apply Thevenin Theorem

$$I_L = \frac{V_{th}}{R_{th} + R_L}$$

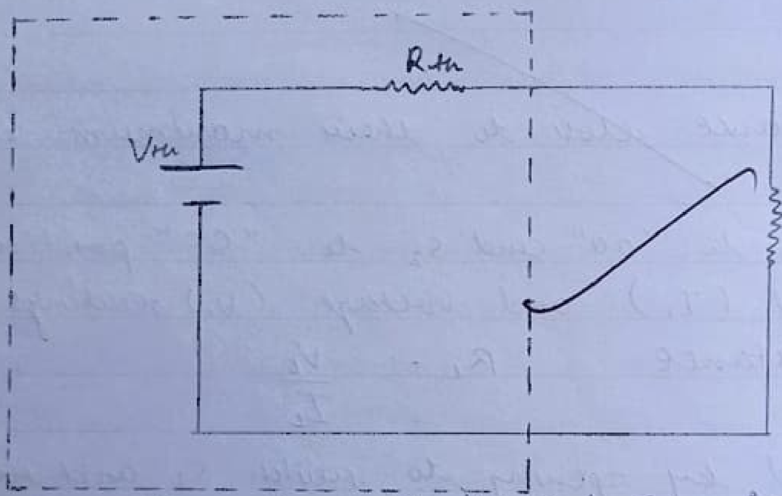
Teacher's Signature :

Observation Table

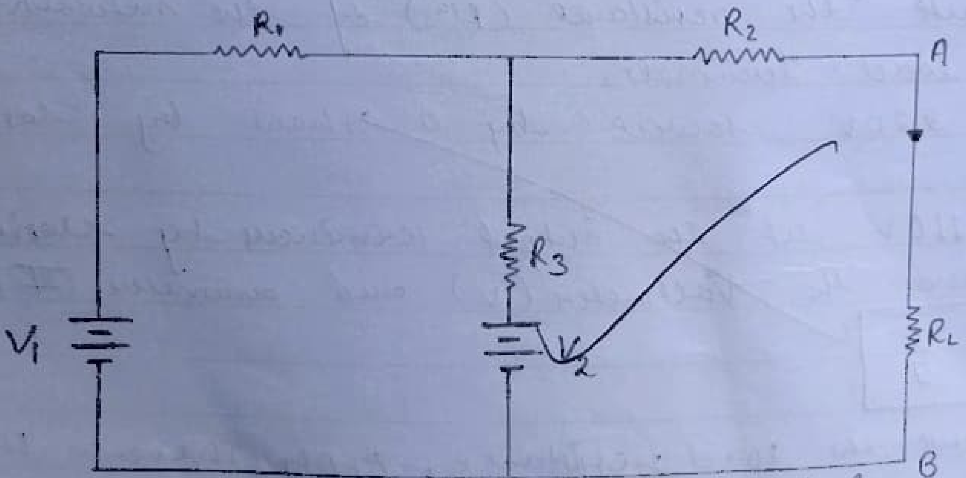
S. No.	Load Current (I_L) Case	Load Voltage (V_L)	Load Resistance (R_L) $= V_L/I_L$	Thevenin Voltage (V_{th}) from Case (2a)	2nd Voltage Source (V) from Case (2b)	Ammeter Reading from Case (2b)	Thevenin Resistance $R_{th} = V/I$	Load Current $I_L = V_{th}/(R_{th}+R_L)$
1.	0.220	88	400	220	310	0.516	600	0.220
2.	0.210	84	400	210	290	0.483	600	0.210
3.	0.200	80	400	200	270	0.450	600	0.200
4.	0.190	76	400	190	250	0.416	600	0.190
5.	0.180	72	400	180	230	0.383	600.01	0.180



Complex linear Network to Thevenin's equivalent



Thevenin's Equivalent Circuit



Circuit diagram for Experiential Set up of Thevenin's Theorem

Date

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(6) Compare the above computed load current with its observation value in step (2) & verify the theorem.

Apparatus Used
Resistor (1K-Ω, 330-Ω, 220-Ω & 110-Ω) Ammeter, Regulated power supply (0 - 30V), multimeter, Bread Board and connecting wires.

Conclusion
As the current flowing through the complex linear circuit and Thevenin's equivalent circuit is same nearly same. It can be determined that any linear network that is "Any linear circuit containing several voltages and resistance can be replaced by just one single voltage in series with single resistance connected across the load.

- Hence Thevenin's theorem is verified.

Teacher's Signature :

Date 28/12/2022

Expt. No. 5.

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Aim:- To verify maximum power transfer theorem.

Theory:- This theorem says that "the maximum power from a network will be transfered in a load, if its value is equal to the value of internal resistance of network seen from load terminals after removing all sources and having behind their internal resistance".
The maximum power transfer theorem is also solved with the help of Thevenin's Theorem.
From fig 1, the internal resistance which leave from fig 1, the internal resistance which leave behind the network is seen from the terminal.

$$A \cdot B \cdot R_{th} = (R_1 \cdot R_3 / R_1 + R_3) + (R_2 \cdot R_4 / R_2 + R_4)$$

where the open circuit voltages are equal to

$$V(R_1/R_1+R_3) - V(R_2/R_2+R_4)$$

After converting the networking into a Thevenin equivalent circuit the power is load to calculated as $I^2 RL$. If a graph is plotted for different values of RL than it is found that maximum power is transfered when RL is equal with R_{th}. For this, a graphical approach is taken from observation made during experiment & result will be carried out for comparing with theoretical value.

Apparatus Required

Connecting wires, power supply, maximum power transfer kit.

Teacher's Signature :

Preparation of table maximum power transfer

V_L (Volts)	I_L (mA)	R_L Ω V_L/I_L	Power W $V_L \cdot I_L$
3.2	21.1	140	67.52
3.6	19.6	180	70.56
4.5	16.5	260	74.25
4.9	15.0	300	73.5
5.5	12.3	340	67.65

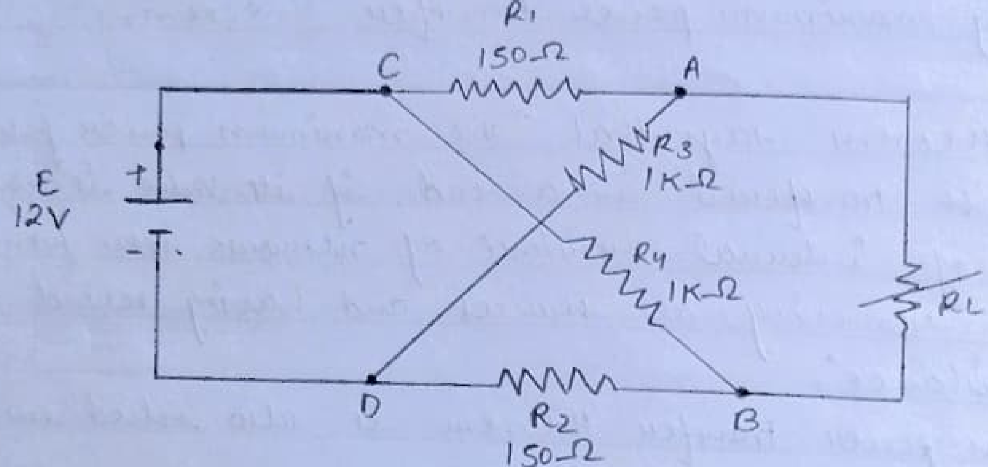

Fig 1: network under study

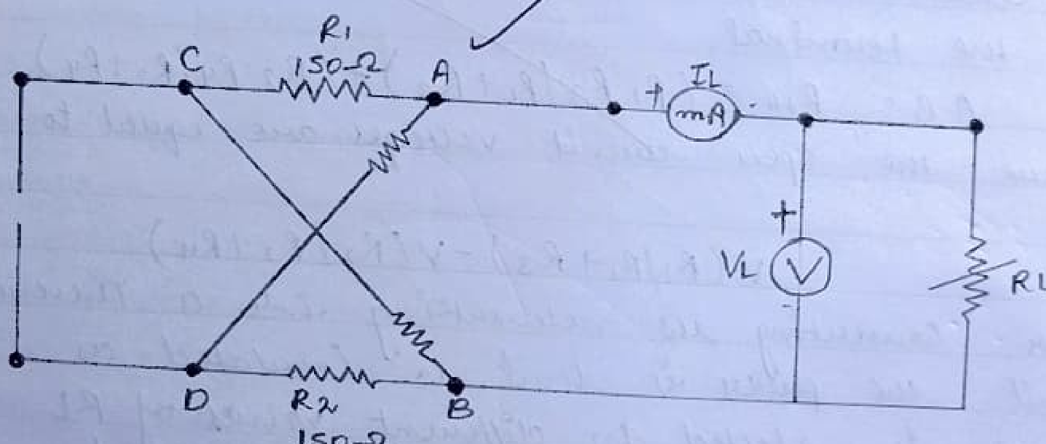

Fig 2. measurement of VL. IL & RL to compute power

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Procedure

1) Connect 12VDC power supply across the CD, point as in fig 2. Connect potentiometer & mA meter across the A-B, as RL, Keep pot fully counter-clockwise thus RL=0.

2) Note the current IL, voltage VL across the RL.

3) Increase RL in steps by potentiometer and note I & V for each increament. Calculate R_L for each step by Ohm's Law V_L/I_L Tabulate the observations for VL, IL, RL & $P = VL \cdot IL$ or $IL^2 RL$.

4) As pot goes from maximum RL, remove it from circuit and note voltage as V_{th}. The current value at zero RL is equal to IN

5) Plot a graph b/w P & RL And RL, from the peak point, compare the result for theoretical Rth & verify maximum power transfer theorem.

Result → maximum power transfer theorem theorem has been Verified.

Neetasingh
4/1/23

Teacher's Signature :

Date 01/02/2023

Expt. No. 6

Page No.

* Aim :- To find the resultant frequency in RLC circuit.

* Apparatus Required :- Series RLC circuit, Generator connecting wires, crocodile probe.

* Theory :- The resonance is phenomenon belongs with resonant circuits having inductance & the capacitance C and R which is a part of inductance (the dC resistance). Sometimes R is included in the circuit for deliberate purposes to widen the bandwidth. When such circuit is connected with an alternating voltage source with such frequency that maximum current flows through the circuit the resonance occurs. The inductive reactance XL becomes equal to capacitive reactance Xc. Thus voltage developed across L and C is almostly equal in magnitude. This property of series resonant circuit the voltage across L or C is Q times of input voltage Vin. Thus the value of Q can evaluated as

$$Q = V_L \text{ or } V_C / V_{in} \quad \text{— (i)}$$

The R of inductance L, plays another important part in determination of Q, as voltage across L, $V_L = V/R \cdot X_L$ and $Q = X_L / R$, thus increament of R decreases the Q. The another method to determine the Q value is to plot bandwidth curve. From plot the higher frequency F_2 and lower F_1 is found. Than from the the

$$Q = F_r / F_2 - F_1 \quad \text{—— (ii)}$$

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Series and parallel RLC Circuit

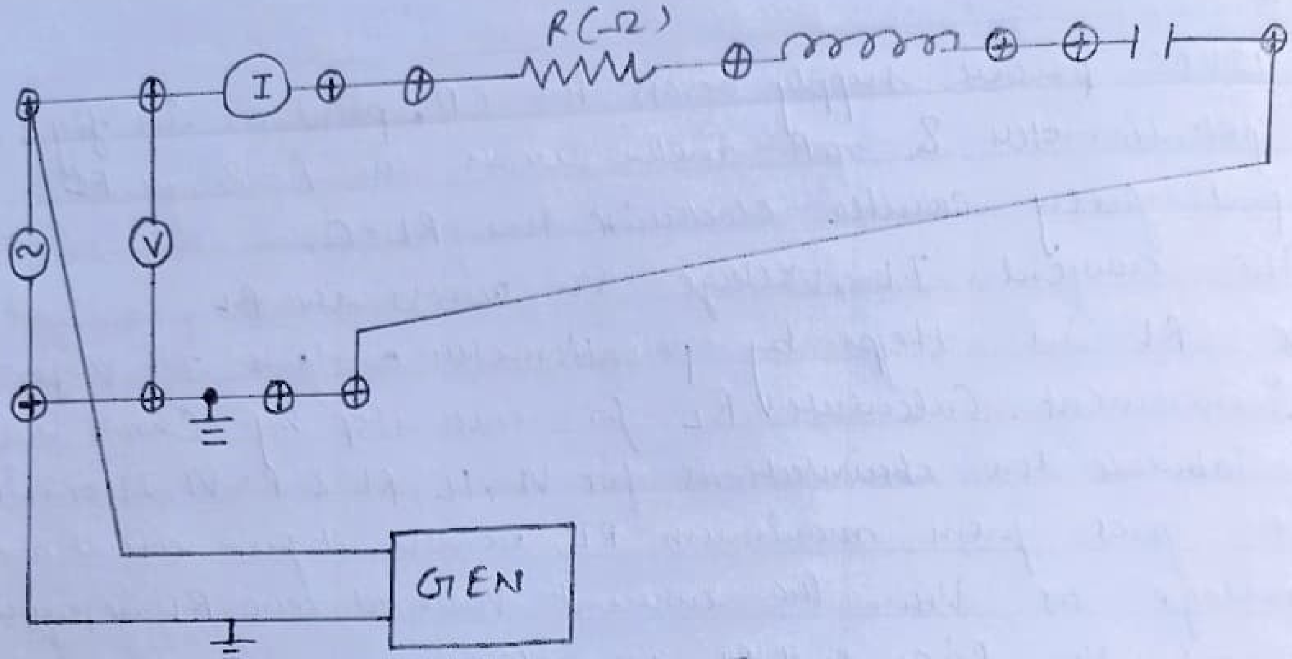
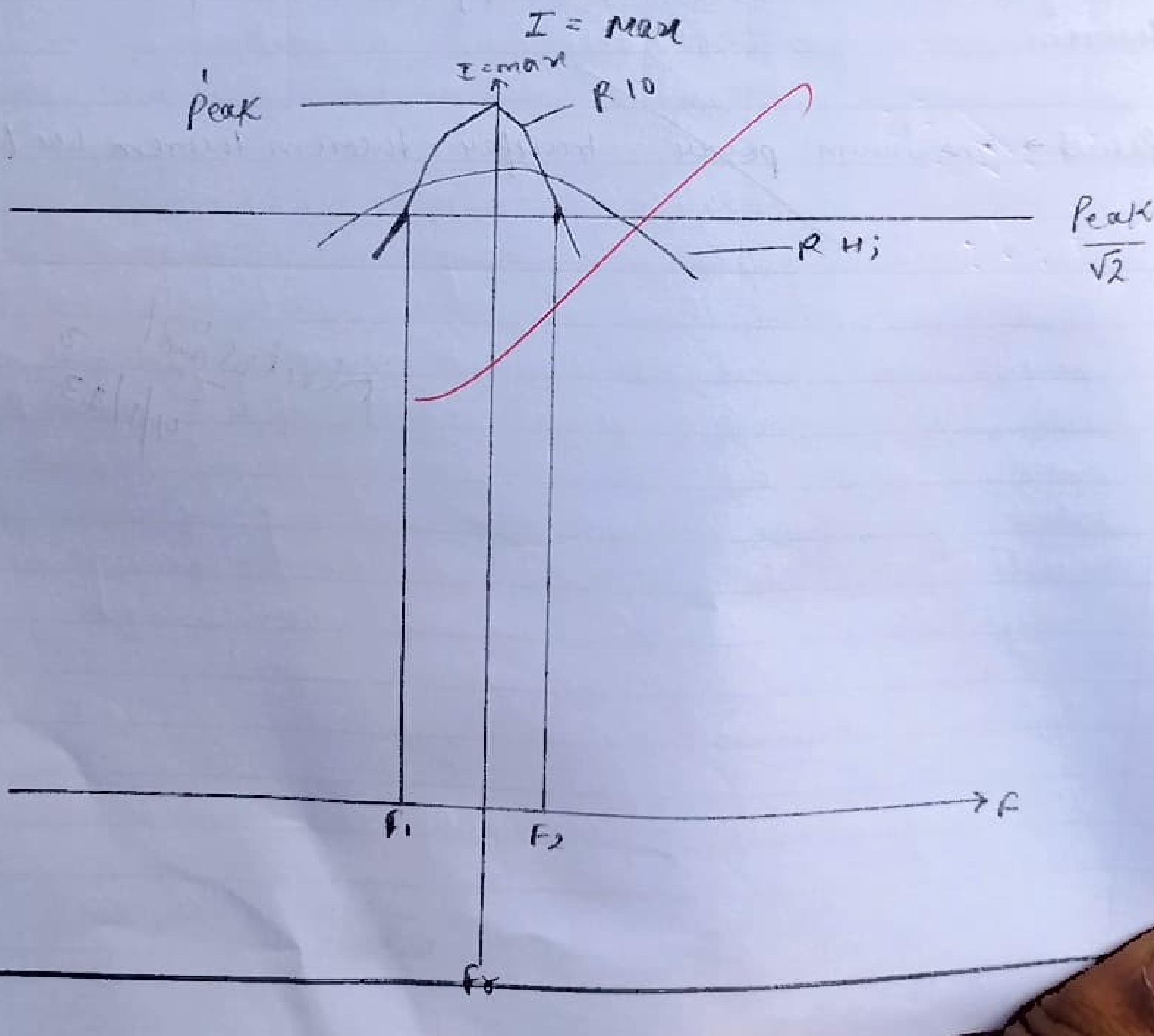


Fig 1



Observation Table

S.No	Down Frequency	Up Frequency	I
1.	-	100	0
2.	-	800	1
3.	-	1500	2
4.	-	2500	5
5.	-	3800	7.5
6.	-	4500	10
7.	-	5400	11.5 → Highest
8.			
9.			
10.			

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The set up consists of three inductance, three capacitors and three resistors. There is an ac Voltmeter (5V fsd) and an ac milliamp meter (20mA fsd) provided to observe the the resonance. An external oscillator (or function gen) required to Conduct experiment.

Connection for series resonance -

$L = 4\ mH$

$C = 0.22\ \mu F$

$R = 5\ \Omega$

Noted 6/2/23

Teacher's Signature :

Expt. No. 7

Date 8/02/23

Page No.

Aim- Study of Polarity Test on a single-phase Transformer.

Apparatus Required :- Connecting Patch cords, Transformer set.

Procedure :- first of all make sure that the earthing of your laboratory is proper and connected to the terminal provided on back side of Panel.

Addition :- • first make sure that the auto transformer knob is at zero-position and main supply of.

- First connect terminals P (Phase terminals) to 8 & N (Neutral terminals) to 9.
- Now to measure the primary voltage of single phase transformer, connect terminals 8 to 10 & terminal 9 to 13.
- Make terminals 13 & 17 short.
- Connect terminal 11 to 12 & terminal 15 to 16 in single phase transformer.
- Connect 10 to 19 & 14 to 18
- Now insert meters in the circuit. For the connect terminals 8 & 9 to V_1 & V_2 respectively.
- Similarly Connected 18 & 19 to V_3 & V_4
- Switch 'on' A/C supply and adjust the autotransformer to get the ~~de~~ desired voltage.
- Record the Voltmeter reading & note reading of first Voltmeter as V_1 & that of second as V_2.
- Switch off the mains supply.

Teacher's Signature :

Observation Table

V_1 = input voltage , V_2 = output / Induced voltage

S. No.	V_1 Volt	$V_1 + V_2$ (additive Polarity) Volts	$V_1 - V_2$ (subtractive polarity) Volt
1	10	21	0
2	20	41	0
3	30	61	0
4	35	71	0
5	40	81	0
6	60	121	0
7	80	161	0
8	100	201	0

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Subtractive

- Remove all the connections made before.
- Connect terminal P to 8 & N to 9.
- Connect 8 to 10, 9 to 13, 13 to 14, 11 to 12, 15 to 16, 10 to 18, 17 to 19
- 8 to V_1, 9 to V_2, 18 to V_3, 19 to V_4
- Switch on AC supply and adjust the auto transformer to get the desired Voltage.
- Record the Voltmeter reading and note reading of first Voltmeter as V_1 & that of second as V_2.
- Switch off the main supply.

Result

We observe that reading of one of the Voltmeter is twice the reading of another Voltmeter in case of additive Polarity & zero in case of subtractive Polarity.

16/2

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