ELP100 LAB REPORT 2

TO VERIFY KVL AND KCL

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GROUP NO.: 29

AIM:

1) To verify KVL and KCL

2) Measure input resistance

3) To study the effect of some modification in special circuits.

APPARATUS:

- Multiple Power Supply
- Resistors (1 of 47 Ω, 1 of 470 Ω, 2 of 100 Ω, 2 of 220 Ω and 1 of 150 Ω)
- Multimeter
- Connecting Wires
- Breadboard

PART I

THEORY:

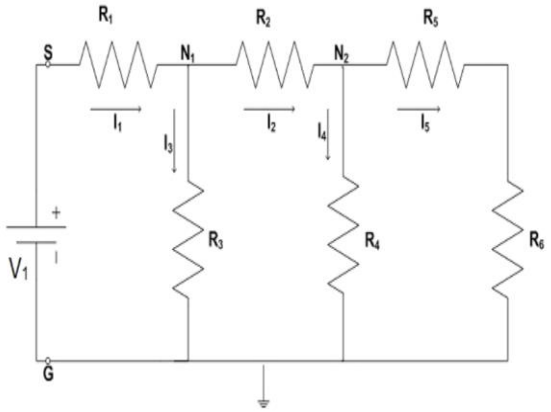
Kirchhoff's Current Law (KCL):

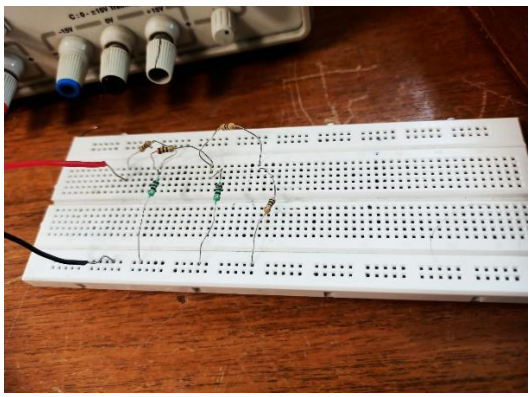
The sum of all currents that enter an electrical circuit junction is 0. The currents enter the junction have positive sign and the currents that leave the junction have a negative sign. Another way to look at this law is that the sum of currents that enter a junction is equal to the sum of currents that leave the junction.

Kirchhoff's Voltage Law (KVL):

The sum of all voltages or potential differences in an electrical circuit loop is 0.

SETUP:





V1=5V, R1=R2=100Ω, R3=R4=220Ω, R5=47Ω, R6=150Ω

OBSERVATION TABLE:

Resistance	Voltage across it	Current through it
R1= 100 OHMS	2.47 V	0.0247 A
R2= 100 OHMS	1.31 V	0.0131 A
R3= 220 OHMS	2.6 V	0.0118 A
R4= 220 OHMS	1.33 V	0.006 A
R5= 47 OHMS	0.3 V	0.006 A
R6=150 OHMS	1.01 V	0.0067 A

I5 after adding 470ohm resistance ≈ 0.0064 A

△I5 ≈ 0.0004 A. A negligible change has been observed.

CALCULATIONS:

At Node N1:

$i1 - i2 + i3 = 0$

$0.0247-0.0131-0.0118= -0.0002 \approx 0$

At Node N2:

$i5 + i4 - i2 = 0$

$0.006 + 0.006 – 0.0131 = -0.0011 \approx 0$

In Loop–1:

$V1 - VR1 - VR3 = 5 - 2.47 - 2.6 = -0.07 \approx 0$

In Loop–2:

$VR3 - VR2 – VR4 = 2.6- 1.31 - 1.33 = -0.04 \approx 0$

In Loop–3:

$VR4 - VR5 - VR6 = 1.33 - 0.3 -1.01 = 0.02 \approx 0$

PART II

THEORY:

Superposition Theorem :–

· The total current in any part of a linear circuit equals the algebraic sum of the currents produced by each source separately. To evaluate the separate currents to be combined, replace all other voltage sources by short circuits and all other current sources by open circuits.

· The different steps of Superposition theorem as follows:

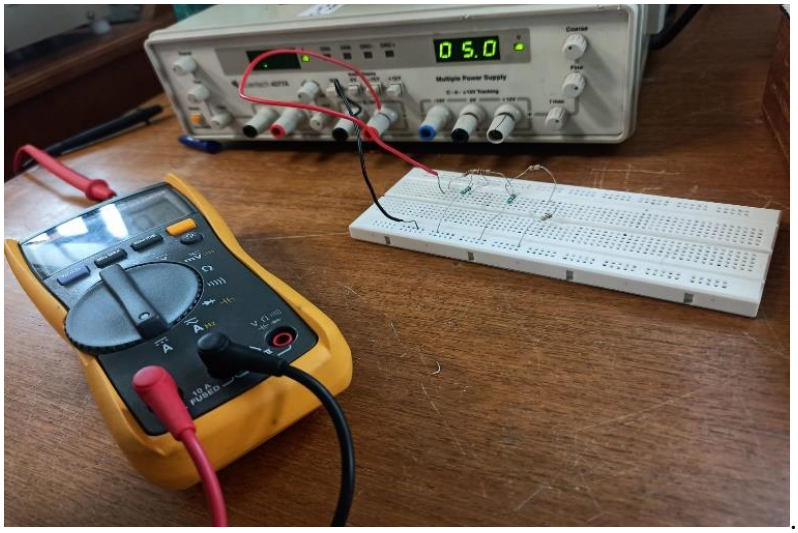
1 Replace all but one of the sources by their internal resistances.

2 Determine the currents in various branches using simple Ohm's law.

3 Repeat the process using each of the sources turn – by turn as the sole source each time.

4 Add all the currents in a particular branch due to each source. This is the desired value of current at that branch when all the sources acting on the circuit simultaneously.

SETUP:



OBSERVATIONS:

VR2 (with V1 and V2 both) = 0.35V

I2 (with V1 and V2 both) = 0.0035A

VR2 (with V2) = 0.96V

I2 (with V2) = 0.0096A

CALCULATIONS:

I2(with V1) - I2(with V2) - I2(with V1 and V2 both) = 0

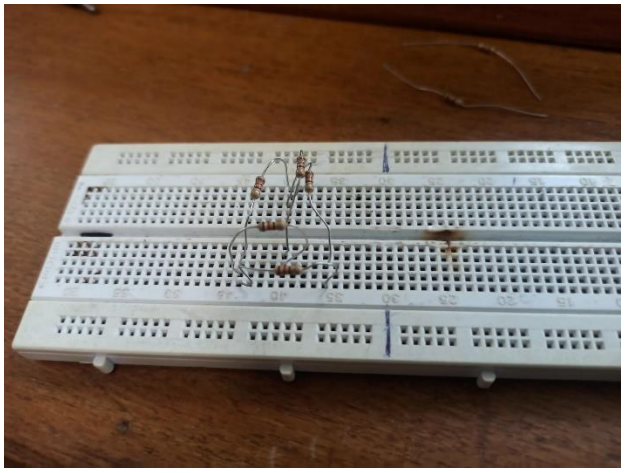
0.0131- 0.0096 – 0.0035 = 0

PART III

THEORY:

The Wheatstone bridge works on the principle of null deflection, i.e. the ratio of their resistances are equal and no current flows through the circuit. Under normal conditions, the bridge is in the unbalanced condition where current flows through the galvanometer. The bridge is said to be in a balanced condition when no current flows through the galvanometer. This condition can be achieved by adjusting the known resistance and variable resistance.

SETUP:



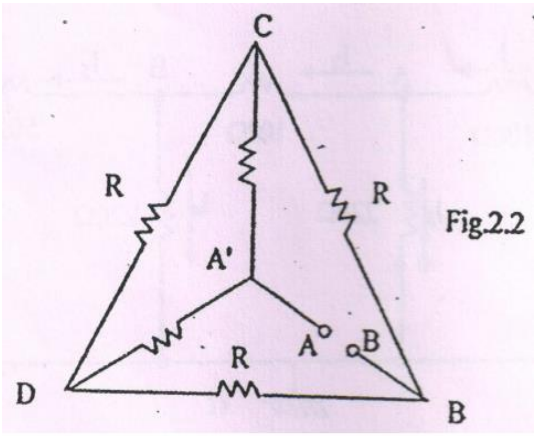


Fig.2.2

Observations:

RA–B = 120.2 ohms

VBC = 2.49 V

VBD = 2.52 V

VCD = 0.021 V

R (short circuit) = 119.8 ohms

IAA' (short circuit) = 5/119.8 = 0.0417 A

R (open) = 119.5 ohms

IAA' (open) = 5/119.2 = 0.0418 A

Since practically the value of resistances may vary a bit in real life, VCD is not exactly 0 but approximately 0. Also VBC and VBD should be equal. But there is slight deviation. But, they follow KVL as VBC − VCD − VBD = 0.

CONCLUSIONS:

Hence we have successfully verified the Kirchhoff's Circuit Laws (KCL and KVL) for a given circuit. We also proved that linear electrical circuits have superposition theorem. Also, we tested the Wheatstone bridge circuit, determining the resistance and voltage by making several alterations, such as short-circuiting and open-circuiting the middle leg, to demonstrate the independence of a balanced Wheatstone Bridge.

Sources of Error:

1] Loose connections.

2] The reading of multimeter might be unstable for first few seconds.

3] Resistance in wires and change due to temperature.

Precautions:

1] Make the connections neat and tight.

2] Circuit should not be left powered for long time.

3] Insulated tools should be used.

THANK YOU!!!