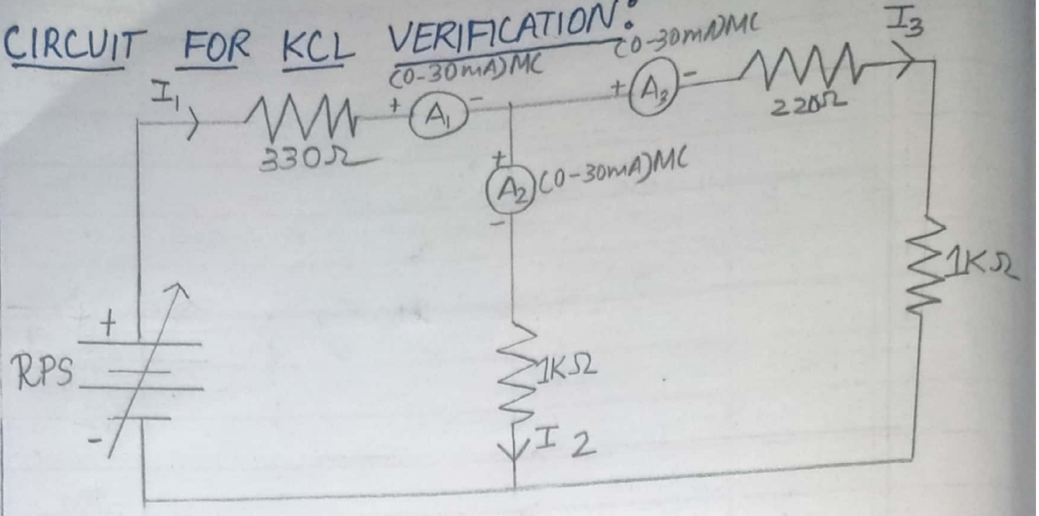
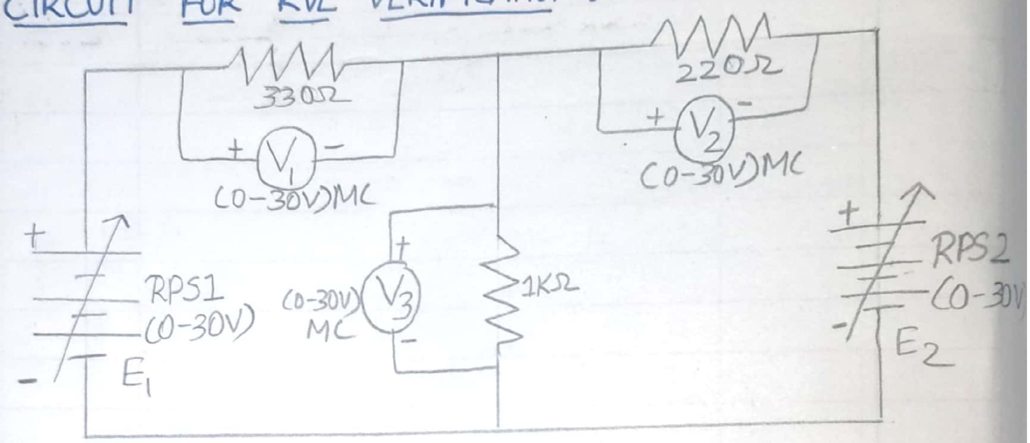
CIRCUIT FOR KCL VERIFICATION:



CIRCUIT FOR KVL VERIFICATION:



KCL - Theoretical values:

S.NO	Voltage E (V)	Current I (mA)			$I_1 = I_2 + I_3$ (mA)
		I_1	I_2	I_3	
1)	5	5.68	3.12	2.56	5.68
2)	10	11.37	6.25	5.12	11.37
3)	15	17.05	9.37	7.68	17.05
4)	20	22.74	12.50	10.24	22.74
5)	25	28.42	15.62	12.80	28.42

Expt01

VERIFICATION OF KIRCHOFF'S LAWS

AIM:

To verify Kirchoff's laws (current and voltage laws) for the given circuit.

APPARATUS REQUIRED:

S.No	Apparatus	Range	Quantity
01)	RPS (regulated power Supply)	(0-30)V	2
02)	Resistance	33Ω, 22Ω, 1KΩ	6
03)	Ammeter	(0-30mA)MC	3
04)	Voltmeter	(0-30V)MC	3
05)	Bread board & wires	-	Required

STATEMENT:

KCL: the Algebric sum of the current meeting/leaving at node/junction is equal to zero.

KVL: In any closed path/mesh, the algebric sum of all the voltage is zero.

PRECAUTION:

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

PROCEDURE FOR KCL:

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

PROCEDURE FOR KVL:

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

KCL - PRACTICAL VALUES:

S.NO	Voltage E (volts)	Current I			$I_1 = I_2 + I_3$ (milliAmp)
		I_1 (mA)	I_2 (mA)	I_3 (mA)	
1)	5	5.68	3.12	2.56	5.68
2)	10	11.37	6.25	5.12	11.37
3)	15	17.05	9.37	7.68	17.05
4)	20	22.74	12.50	10.24	22.74
5)	25	28.42	15.62	12.80	28.42

KVL - THEORETICAL VALUES:

S.NO	RPS		Voltage (V)			$E = V_1 + V_2$ (volts)
	E_1	E_2	V_1	V_2	V_3	
1)	5	5	0.58	4.42	-0.58	5
2)	10	10	1.17	8.83	-1.17	10
3)	15	15	1.75	13.25	-1.75	15
4)	20	20	2.33	17.67	-2.33	20
5)	25	25	2.92	22.08	-2.92	25

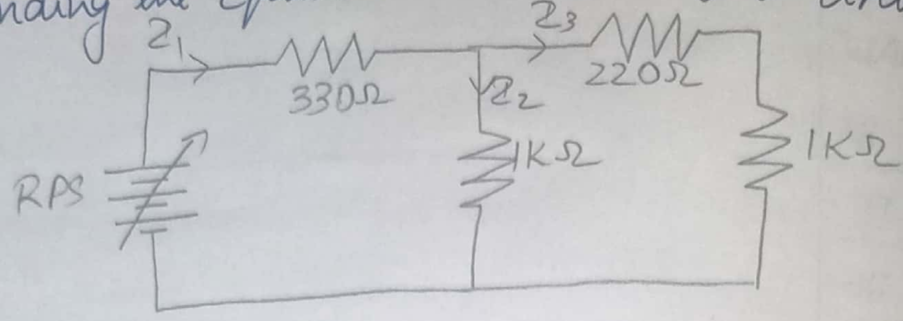
KVL - PRACTICAL VALUES:

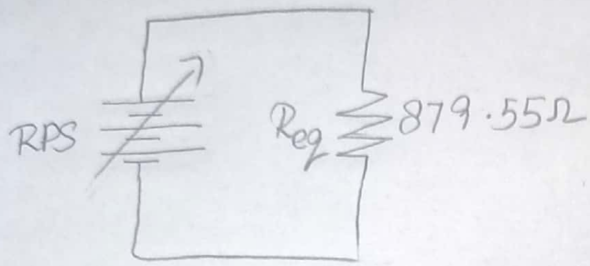
S.NO	RPS		Voltage			$E = V_1 + V_2$ (volts)
	E_1 (V)	E_2 (V)	V_1 (V)	V_2 (V)	V_3 (V)	
1)	5	5	0.58	4.42	-0.58	5
2)	10	10	1.17	8.83	-1.17	10
3)	15	15	1.75	13.25	-1.75	15
4)	20	20	2.33	17.67	-2.33	20
5)	25	25	2.92	22.08	-2.92	25

CALCULATION:-

KCL:

Finding the Equivalent resistance of given circuit





for $E = 5V$,

$$I_1 = \frac{E}{R_{eq}} = \frac{5}{879.55} = 5.68\,mA$$

using current division rule,

$$I_2 = I_1 \times \frac{\text{opp. resistance}}{\text{same resistance} + \text{opp. resistance}}$$

$$= 5.68 \times \frac{1220}{2220}$$

$$= 3.12\,mA$$

Similarly, $I_3 = I_1 \times \frac{\text{opp. resistance}}{\text{same resistance} + \text{opp. resistance}}$

$$= 5.68 \times \frac{1000}{2220}$$

$$= 2.56\,mA$$

By KCL,

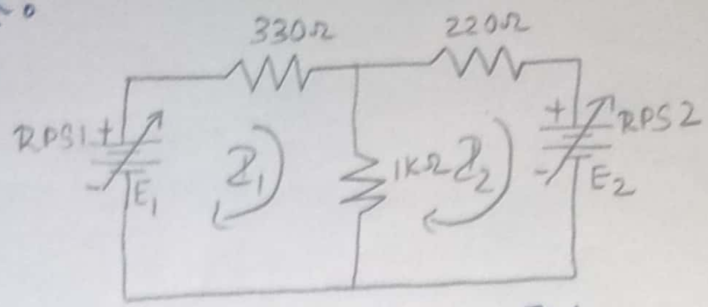
$$I_1 = I_2 + I_3$$

LHS, $I_1 = 5.68\,mA$

RHS, $I_2 + I_3 = 3.12 + 2.56 = 5.68\,mA$

$\therefore$ LHS = RHS

KVL:



for RPS 1 and RPS2 = 5V

by Mesh Analysis,

Loop 1

$330I_1 + 1000(I_1 - I_2) = 5$

$\Rightarrow 1330I_1 - 1000I_2 = 5$ —①

Loop 2

$-1000(I_1 - I_2) + 220I_2 + 5 = 0$

$\Rightarrow 1000I_1 - 1220I_2 = 5$ —②

Solving ① & ② by Cramer's rule,

$$\Delta = \begin{vmatrix} 1330 & -1000 \\ 1000 & -1220 \end{vmatrix} = 622600$$

$$\Delta_1 = \begin{vmatrix} 5 & -1000 \\ 5 & -1220 \end{vmatrix} = -1100$$

$$\Delta_2 = \begin{vmatrix} 1330 & 5 \\ 1000 & 5 \end{vmatrix} = 1650$$

$$I_1 = \frac{\Delta_1}{\Delta} = -0.00177A$$

$$I_2 = \frac{\Delta_2}{\Delta} = +0.00265A$$

$$I_2 - I_1 = 0.00442A$$

$V_1 = -0.00177 \times 330$

$= -0.58V$

$V_2 = 0.00442 \times 1000$

$= 4.42V$

$V_3 = 0.00265 \times 220$

$= 0.58V$

By KVL, potential drop = potential gain

$E = V_1 + V_2 = 0.58 + 4.42$

$= 5V$

RESULT:

Thus the Kirchoff's current law and Kirchoff's voltage law are verified.