EE 1302 : INTRODUCTION TO ELECTRICAL ENGINEERING

LABORATORY 02: VERIFICATION OF CIRCUIT LAWS

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Table 1: THE EXPERIMENT VALUES OF KURCHCHOFS CURRENT AND VOLTAGE LAW

	Vs1 (V)	Vs2 (V)	R1 (Ω)	R2 (Ω)	R3 (Ω)	I1 (A)	I2 (A)	I3 (A)	V1 (V)	V2 (V)	V3 (V)
1	9	16	38	68	38	0.055	0.130	0.180	2.1	8.4	17.5
2	12	18	42	74	40	0.089	0.125	0.205	3.6	8.6	21
3	15	20	20	30	20	0.230	0.300	0.500	4.5	8.8	20
4	16	20	22	28	16	0.285	0.350	0.600	6.1	9.4	18.5

Table 2: THE EXPERIMENTAL VALUES OF SUPERPOSITION THEOROM

		I1 (A)	I2 (A)	I3 (A)
1	With Vs1 only	0.195	-0.070	0.125
2	With Vs2 only	-0.035	0.165	0.130
3	With Vs1 and Vs2	0.160	0.095	0.255

CALCULATIONS

KIRCOFF'S CURRENT LAW AND VOLTAGE LAW

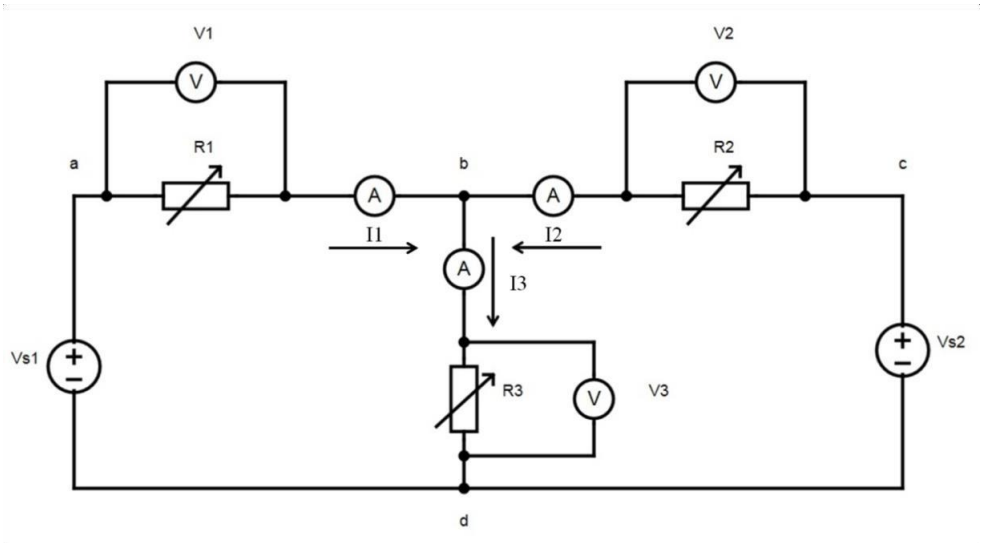


FIGURE 1 : CIRCUIT DIAGRAM 1

With two source,

Loop 1;

$V_{s1}+R_1I_1+R_3I_3 = 0$ Equation 1

$(60+15)\ I_1 - 15\ I_2 = 14$

$75\ I_1 - 15\ I_2 = 14$

Loop 2;

$V_{s2}+I_2R_2+I_3R_3 = 0$ Equation 2

$(30+15)I_2 - 15\ I_1 = -7$

$45\ I_2 - 15\ I_1 = -7$

$I_1 = 0.167A$

$I_2 = 0.100A$

$I_3 = I_1 + I_2$

$I_3 = 0.167A$

$$\text{Error \%} = \frac{Theoretical\ Values - Experimental\ Values}{Theoretical\ Values} \times 100$$

For result 1 Kirchhoff's voltage V1,

$$\text{Error \%} = \frac{1.976 - 2.1}{1.976} \times 100$$

$$= -6.27\%$$

For result 1 Kirchhoff's current I1,

$$\text{Error \%} = \frac{0.052 - 0.055}{0.052} \times 100$$

$$= -5.769\ \%$$

SUPER POSITION THEOROM

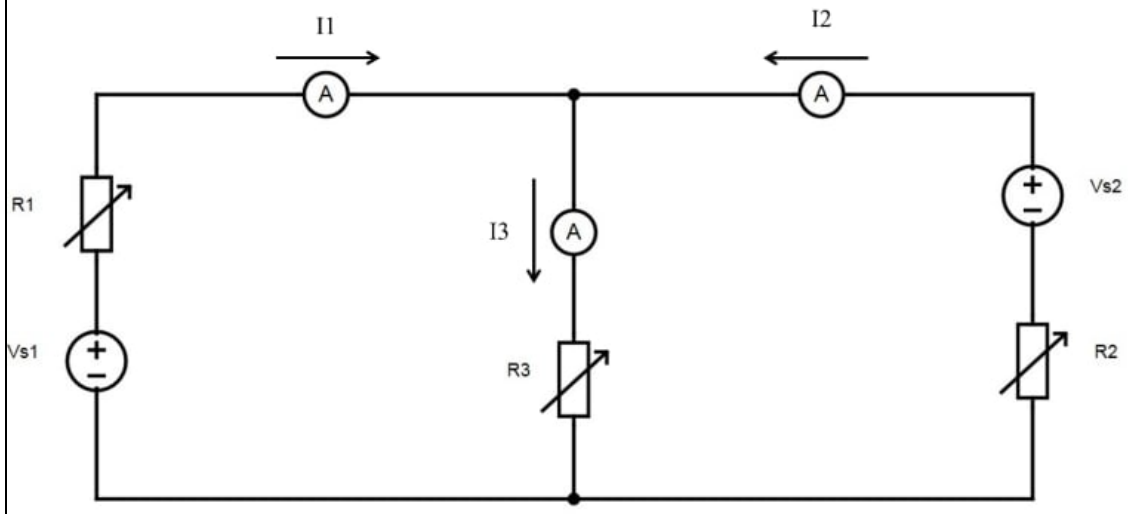
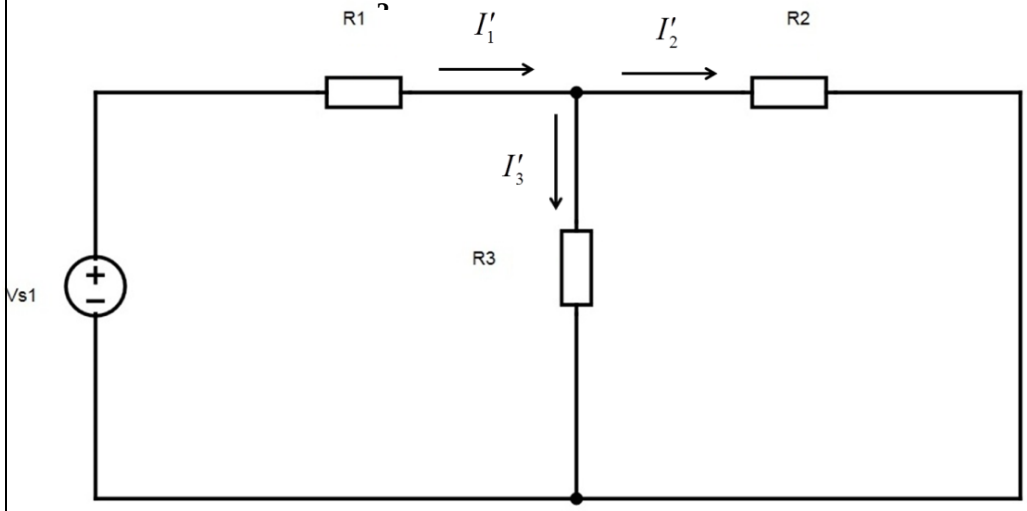
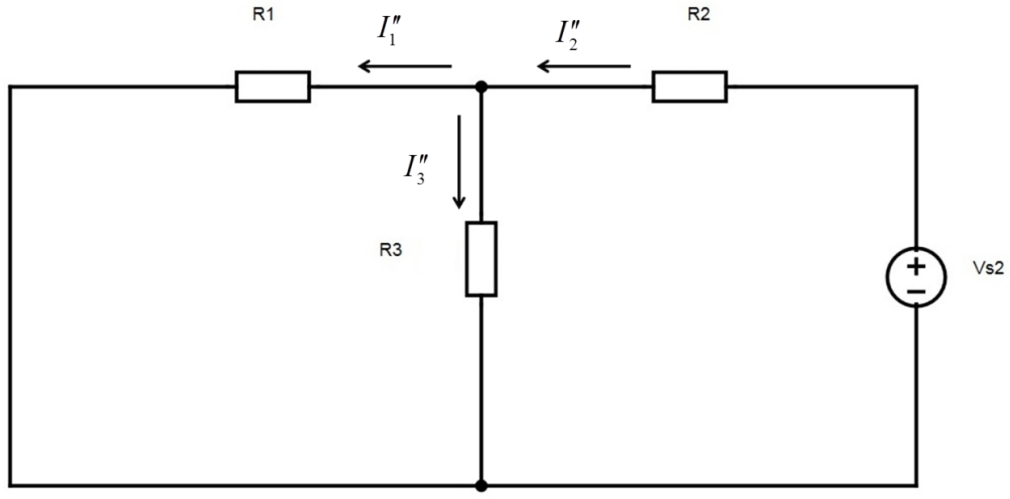


FIGURE 2: **CIRCUIT DIAGRAM**





with S1 sources,

Loop 1,

$V_{s1}+RI_1+R_3I_3 = 0$ Equation 3

$(60+15)\ I_1 - 15\ I_2 = 14$

$75\ I_1 - 15\ I_2 = 14$

Loop 2;

$V_{s2}+I_2R_2+I_3R_3 = 0$ Equation 4

$(30+15)_{\ 2} - 15\ I_1 = 0$

$0 = 45\ I_2 - 15\ I_1 = 0$

$I_1 = 0.200A$

$I_2 = -0.067A$

$I_3 = I_1 + I_2$

$I_3 = 0.133A$

With S2 sources,

Loop 1;

$V_{s1}+R_1I_1+R_3I_3 = 0$ Equation 5

$(60+15)\ I_1 - 15\ I_2 = 0$

$75\ I_1 - 15\ I_2 = 0$

Loop 2;

$V_{s2}+I_2R_2+I_3R_3 = 0$ Equation 6

$(30+15)\ i_2 - 15\ i_1 = -7$

$45\ I_2 - 15\ I_1 = -7$

$I_1 = -0.034A$

$I_2 = 0.167A$

$I_3 = I_1 + I_2$

$I_3 = 0.134A$

TABULATION

Table 3: THEORITICAL AND EXPERIMENTAL VALUES OF KCL AND KVL

		Theoretical (V)	Experimental (V)	Error %		Theoretical (A)	Experimental (A)	Error %
1	V1	1.976	2.1	-6.27	I1	0.052	0.055	-5.769
	V2	8.976	8.4	6.41	I2	0.132	0.1300	1.515
	V3	7.03	8.6	-22.33	I3	0.185	0.180	2.702
2	V1	3.528	3.6	-2.04	I1	0.084	0.089	-5.952
	V2	9.546	8	16.19	I2	0.129	0.125	3.100
	V3	8.48	10.5	-23.33	I3	0.212	0.205	3.301
3	V1	4.38	4.5	-2.73	I1	0.219	0.230	-5.022
	V2	9.39	8.8	6.28	I2	0.313	0.300	4.153
	V3	10.62	10	5.83	I3	0.531	0.500	5.838
4	V1	5.962	6.2	-3.991	I1	0.271	0.285	-5.166
	V2	9.968	9.4	5.698	I2	0.356	0.350	1.685
	V3	10.032	9.2	8.293	I3	0.627	0.600	4.306

Table 4: THEORITICL AND EXPERIMANTAL VALUES OF SUPERPOSITION THEOROM

	I1 (A)		I2 (A)		I3 (A)	
	Theoretical	Experimental	Theoretical	Experimental	Theoretical	Experimental
1	0.2	0.195	-0.067	-0.070	0.133	0.125
2	-0.034	-0.035	0.167	0.165	0.134	0.130
3	0.166	0.1600	0.1	0.095	0.267	0.255

DISCUSSION

Kurchoff's Current law and voltage law

Kurchoff 's current law is defined as the algeberic sum of the currents entering a node s zero. And also the kurchoff 's second law is around the closed loop the algeberic sum of the voltages are zero. Considering about the values between theoretical and experiment are not same.

In the theoretical values, it satisfies these theoroms. but for the experimental values doesn't satisfy these theroms but it goes behind it. Lets get values ,

$I_1 = 0.055$

$I_2 = 0.130$

$I_3 = 0.180$

$I_1 + I_2 = 0.185$

So it can be told that it goes behind it.

In this time we tell there is an error .

To calculate the error this is the eqation for that.

Error =(Theoritcal values- experimental values)/ Theoritical Values

For the errors there are many reasons.

It can be done by the way of measuring by the human. Parellex error ,less ability of using measuring instruments and the booking errors also can be done.

Then considering about the wires and the measuring instruments also have the resistance. So that also can be occurred the errors. To get a high accuracy of a measurement it is possible to develop the ability of using the masuring instruments.

Super Position Theorom

Super position therom is defined, as the current in any branch of a linear network with more than one voltage source is the algerberic sum of the currents obtained by each source acting separately with all oter sources being replaced by their respective impedense.

Table 4 shows that there is a different between the theoretical and experimental values that were obtained.

$I_2 + I_3 = I_1$

Considering an example from the theoretical values,

$I_2 + I_3 = 0.195\text{-}0.070$

$I_1 = 0.125$

So that the answers are not same in the experiment way.But they roughly same.

For that the resistance of the ammeter and voltmeter affected to these minor errors. Resistance of the wires, human errors and the weather conditions are also gatered to that.

Super position theorem only applied for the linear circuit and doesn't apply to non linear circuits. While there is large number of sources, it is useful to determining which branch of the circuit to fix and also it is useful to convert the large circuit into small circuit. The main thing to apply super position theorem is there have many emf sources.