Fall 2021

EEE/ETE 141L

Electrical Circuits-I Lab(Sec-5)

Faculty : Md. Abu Obaidah (AbO)

Instructor: Farhana Atuyar Saleh

Lab No. : 05

Date of Performance : 01.12.2021

Date of Submission : 08.12.2021

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Experiment Name: Verification of Superposition Theorem

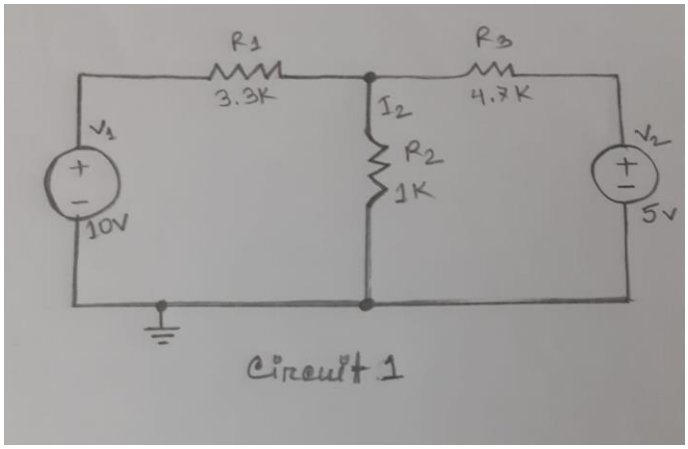
Objective:

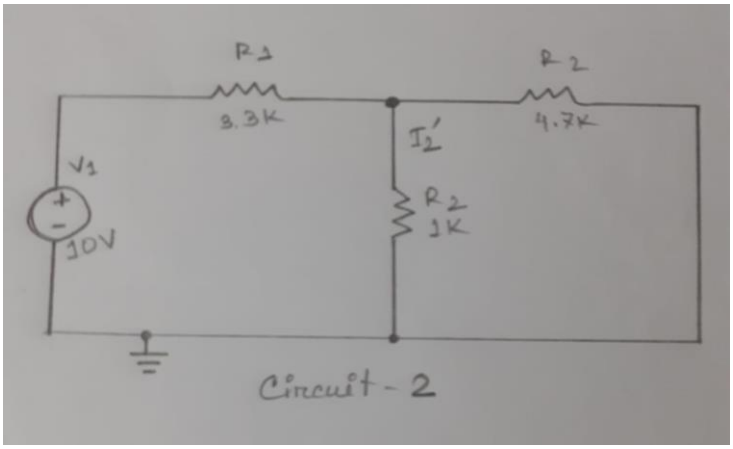
- To verify Superposition Theorem.

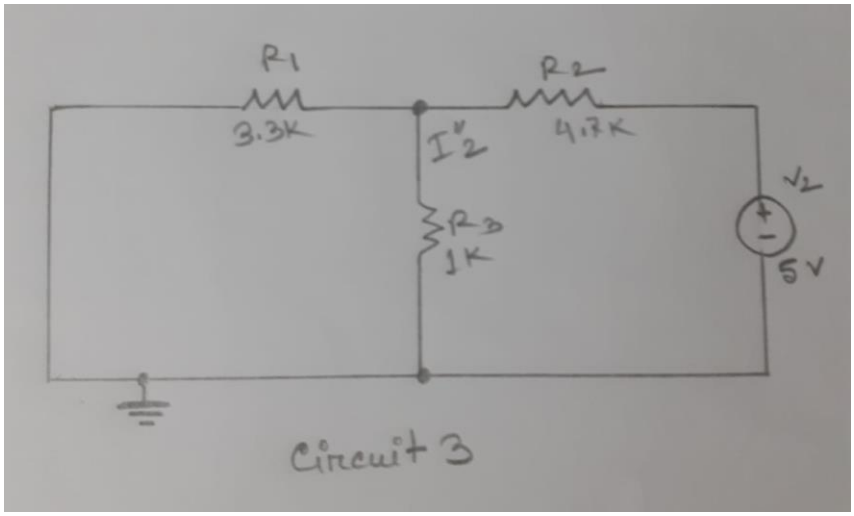
List of Equipment:

- Trainer Board
- DMM
- 1 x 3.3kΩ resistor
- 1 x 4.7kΩ resistor
- 1 x 1kΩ resistor
- Multisim

Circuit Diagram:







Data Table:

Table 1:

I_2	I'_2	I''_2	$I'_2 + I''_2$
2.701mA (Downwards)	1.99mA (Downwards)	0.701mA (Downwards)	2.692mA

Table 2:

V_{R1}	V'_{R1}	V''_{R1}	$V'_{R1} + V''_{R1}$
+7.299V-	+8.001V-	-0.702V+	+7.299V-

Table 3:

V_{R2}	V'_{R2}	V''_{R2}	$V'_{R2} + V''_{R2}$
+2.701V-	+1.99V-	+0.702V-	+2.7V-

Table 4:

V_{R3}	V'_{R3}	V''_{R3}	$V'_{R3} + V''_{R3}$
-2.299V+	+1.99V-	-4.298+	-2.299V+

Results:

RESULT :

$$I_2 = \frac{2.701 - 2.697}{2.701} \times 100\% = 0.15\%$$

$$I'_2 = \frac{1.999 - 1.995}{1.999} \times 100\% = 0.20\%$$

$$I''_2 = \frac{0.702 - 0.702}{0.702} \times 100\% = 0\%$$

$$V_{R_1} = \frac{7.299 - 7.287}{7.299} \times 100\% = 0.0016\%$$

$$V'_{R_1} = \frac{8.001 - 7.986}{8.001} \times 100\% = 0.19\%$$

$$V''_{R_1} = \frac{0.702 - 0.6995}{0.702} \times 100\% = 0.36\%$$

$$V_{R_2} = \frac{2.714 - 2.702}{2.714} \times 100\% = 0.44\%$$

$$V'_{R_2} = \frac{2.014 - 1.999}{2.014} \times 100\% = 0.74\%$$

$$V''_{R_2} = \frac{0.702 - 0.6995}{0.702} \times 100\% = 0.36\%$$

$$V_{R_3} = \frac{2.999 - 2.287}{2.299} \times 100\% = 0.52\%$$

$$V'_{R_3} = \frac{4.3005 - 4.298}{4.3005} \times 100\% = 0.66\%$$

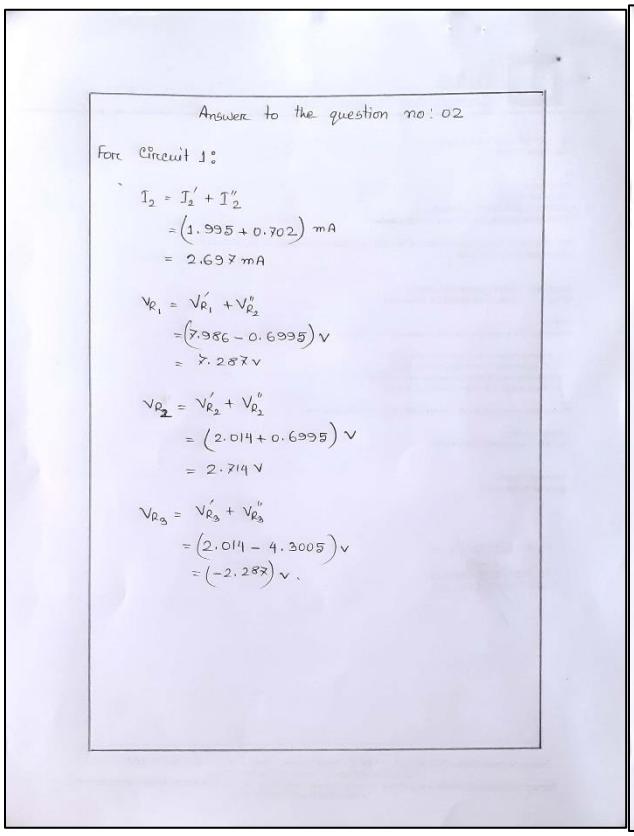
$$V''_{R_3} = \frac{2.014 - 1.999}{2.014} \times 100\% = 0.74\%$$

Question/Answer:

1. What is Superposition Theorem?

Answer: The superposition principle states that the voltage across (or current through) an element in a linear circuit is the algebraic sum of the voltages across (or currents through) that element due to each independent source acting alone.

2. Theoretically calculate all values of Table 1 to Table 4. Show all the steps in details.



Answer to the question no: 02

For Circuit 1°

$I_2 = I_2' + I_2''$

$= (1.995 + 0.702)$ mA

$= 2.697$ mA

$V_{R_1} = V_{R_1}' + V_{R_2}''$

$= (7.986 - 0.6995)$ V

$= 7.287$ V

$V_{R_2} = V_{R_2}' + V_{R_2}''$

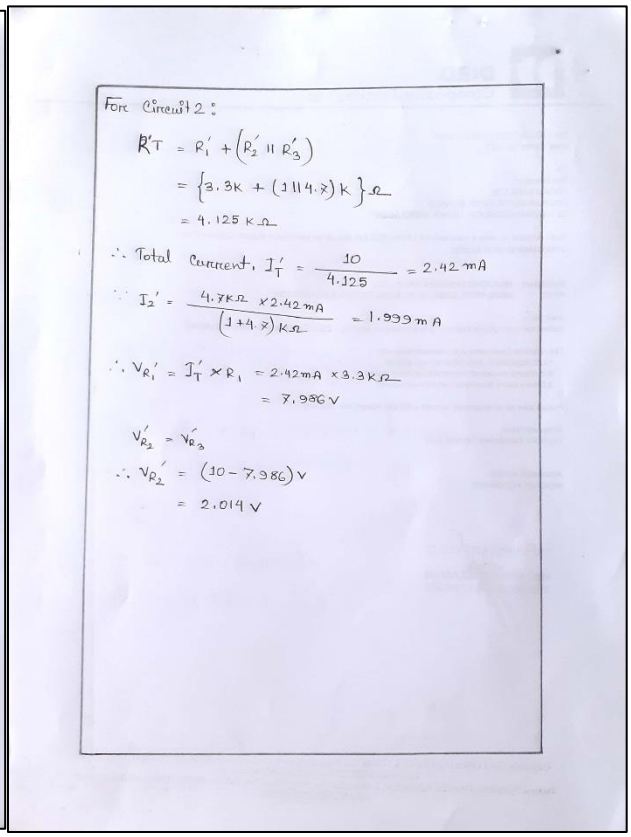
$= (2.014 + 0.6995)$ V

$= 2.714$ V

$V_{R_3} = V_{R_3}' + V_{R_3}''$

$= (2.014 - 4.3005)$ V

$= (-2.287)$ V.



For Circuit 2°:

$R'_T = R_1' + (R_2' \parallel R_3')$

$= \{3.3k + (1 \parallel 4.7)k\}\Omega$

$= 4.125\ k\Omega$

∴ Total current, $I_T' = \frac{10}{4.125} = 2.42$ mA

$I_2' = \frac{4.7k\Omega \times 2.42mA}{(1+4.7)k\Omega} = 1.999$ mA

$\therefore V_{R_1}' = I_T' \times R_1 = 2.42mA \times 3.3k\Omega$

$= 7.986$ V

$V_{R_2}' = V_{R_3}'$

$\therefore V_{R_2}' = (10 - 7.986)$ V

$= 2.014$ V

Answer:

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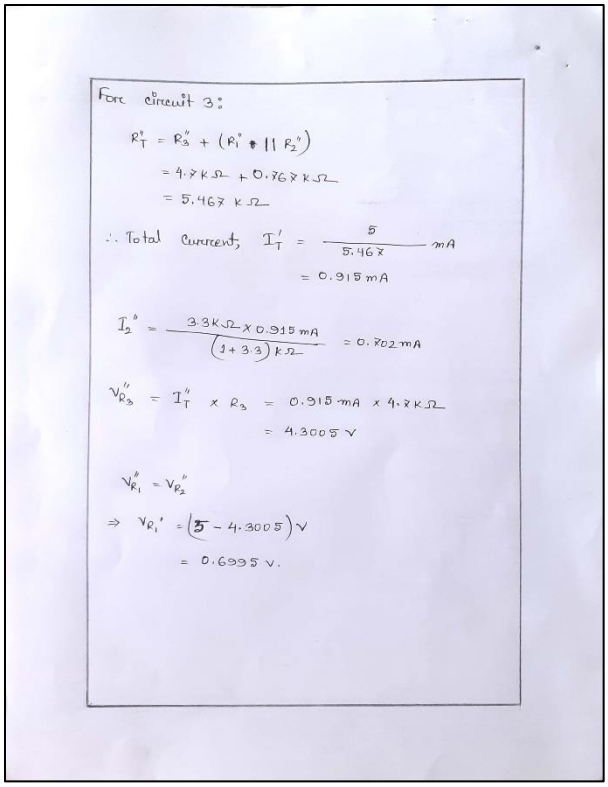


3. Using measured data, show that your circuit followed superposition theorem.

Answer:

We Know,

$V_2 = V'_2 + V''_2$

$I_2 = I'_2 + I''_2$

$I_2 = I'_2 + I''_2 = 1.999 + 0.702 = 2.701mA$

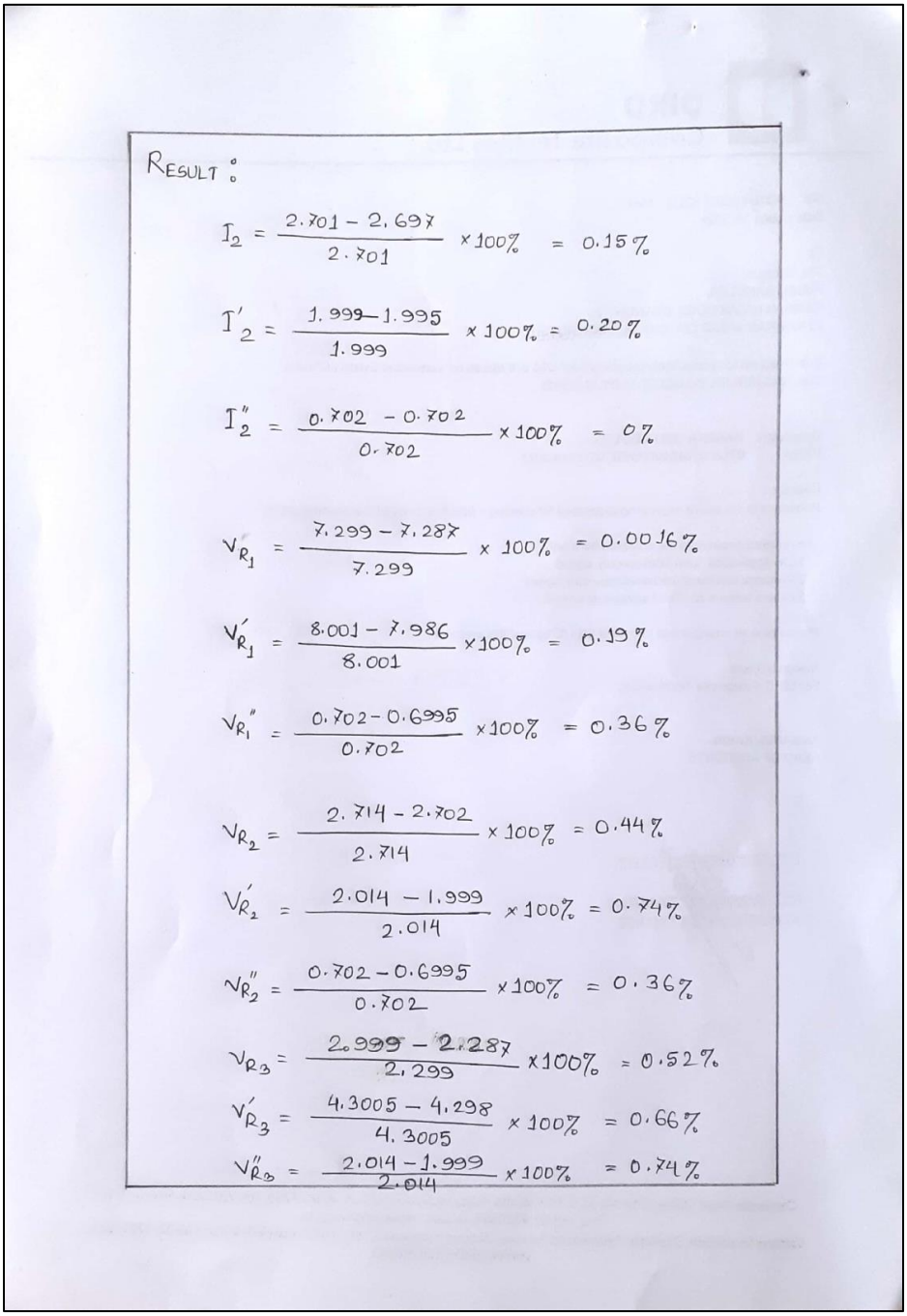
$V_1 = V'_1 + V''_1 = 8.001 + 0.702 = 7.229\ V$

$V_2 = V'_2 + V''_2 = 1.999 + 0.702 = 2.701\ V$

$V_3 = V'_3 + V''_3 = 1.999 – 4.298 = -2.299V$

4. Find the % Error between your theoretical and experimental values.

Answer:



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Discussion:

From the lab 5, we learned about Verification of Superposition Theorem.

As, it was an online lab, we had to use multisim to do the experiments. So, we didn't have to face many errors or faults. We could find the theoretical values easily.

If we would have done the lab offline, we could have faced many errors such human errors, environmental errors or mechanical errors. Also, we could have faces errors using DMM, cables, breadboard connection etc.