Department of CSE

CSE209 Lab

Course Name: Electrical Circuits

Course Code: CSE209

Section No: 2

Experiment No: 06

Name of the Experiment: Verification of Thevenin's Theorem.

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Submitted to

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Objectives:

1. To verify the Thevenin's theorem theoretically, experimentally, and using PSpice simulation.

Circuit Diagram(s):

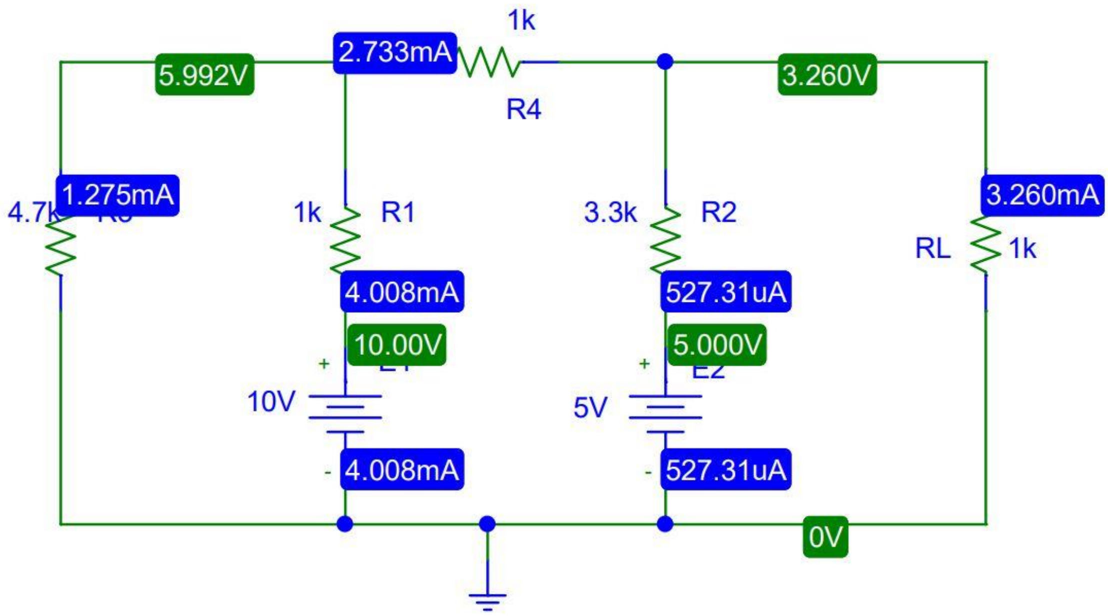

Figure 1.PSpice Schematic diagram for circuit 1

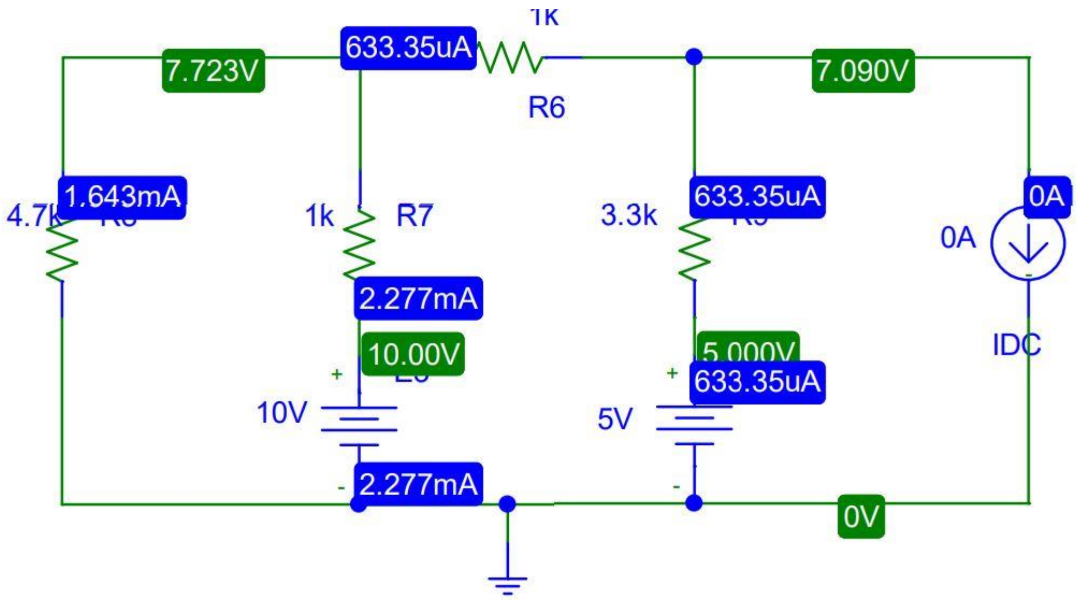

Figure 2.PSpice Schematic diagram for circuit 2

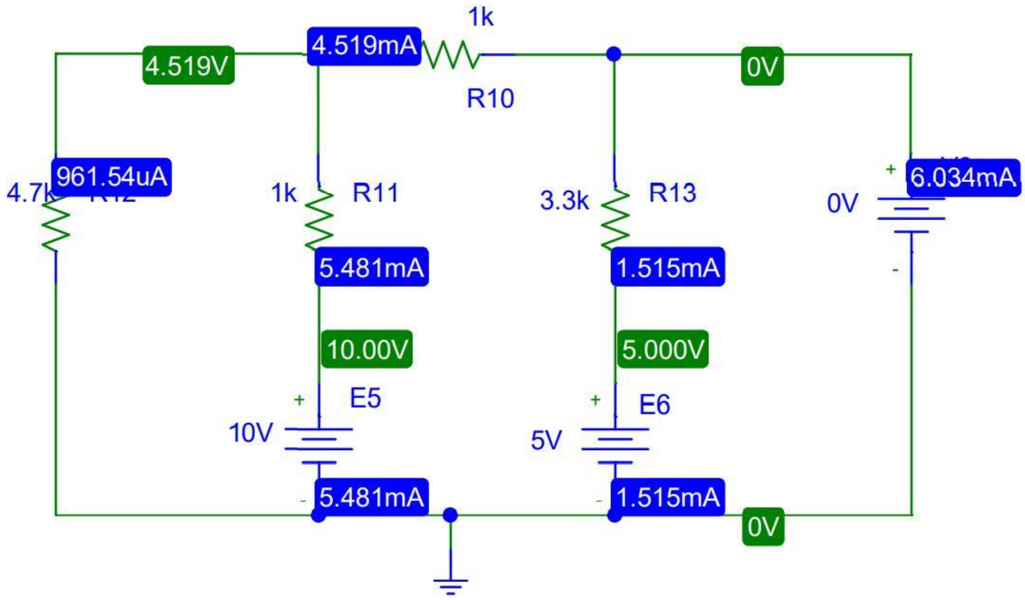

Figure 3.PSpice Schematic diagram for circuit 3

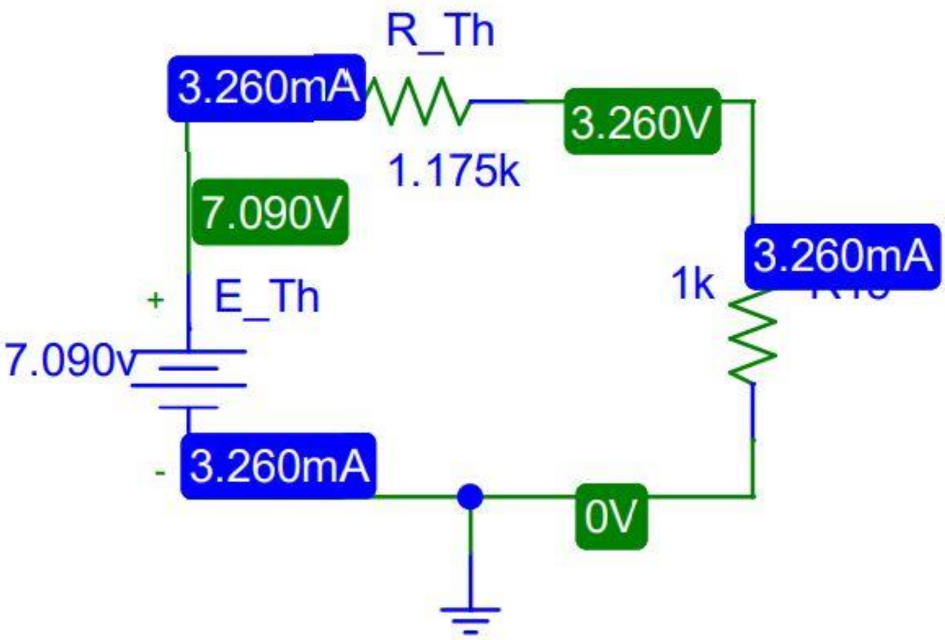

Figure 4.PSpice Schematic diagram for circuit 4

Experimental Datasheet:

Table 1.Experimental Datasheet for determining Thevenin's equivalent circuit.

Measured Value of E_1 (V)	Measured Value of E_2 (V)	Measured Value of V_L(V)	Measured value of I_L (mA)	Measured value of V_{OC} (V)	Measured value of I_{SC} (mA)	Measured values of resistors Ω
10	**5**	**3.26**	**3.26**	**7.090**	**6.034**	**R_1 = 1K R_2 = 3.3K R_3 = 4.7K R_4 = 1K R_L = 1K**

Table 2.Experimental Datasheet for Thevenin's equivalent circuit.

$E_{th} = V_{OC}$	$R_{th} = V_{OC} / I_{SC}$	Measured Value of V_L	Measured Value of I_L
7.090	**1.175KΩ**	**3.26**	**3.26**

Post-Lab Report Questions and Answers:

1. Theoretically calculate V_L and I_L in Figure 1 using measured values of E_1, E_2, R_1, R_2, R_3, R_4, and R_L. Then theoretically calculate V_{OC} in Figure 2 and I_{SC} in Figure 3 using measured values of E_1, E_2, R_1, R_2, R_3, R_4, and R_L. From the values of V_{OC} and I_{SC}, determine E_{Th} and R_{Th}. Theoretically calculate V_L and I_L in Figure 4 using calculated values of E_{Th} and R_{Th} and the measured value of RL. Verify the Thevenin's theorem from calculated data?

<u>Answer:</u>

In figure 1 Applying KVL all the Mesh we get,

$(5.7k)i_1 - (1k)i_2 = -10$

$(-1k)i_1 + (5.3k)i_2 - (3.3k)i_3 = 10 - 5$

$(-3.3k)i_2 + (4.3k)i_3 = 5$

So, I_L = 3.26mA and V_L = 3.26V

In figure 2, is in open circuit,

So we are applying KCL at node x,

$E_{Th} = V_{OC} = 3.3ki_2 + 5V$

Applying KVL at mesh 1 and 2,

$(5.7k)i_1 - (1k)i_2 = -10$

$(-1k)i_1 + (5.3k)i_2 - (3.3k)i_3 = 10 - 5$

$i_2 = 0.633mA$

$V_{OC} = 3.3k \times (0.633m) + 5V$

=7.090V

In figure 3, Applying KVL all the Mesh we get,

$(5.7k)i_1 - (1k)i_2 = -10$

$(-1k)i_1 + (5.3k)i_2 - (3.3k)i_3 = 10 - 5$

$(-3.3k)i_2 + (3.3k)i_3 = 5$

$So, I_{SC} = 6.034mA$

$$R_{Th} = \frac{V_{OC}}{I_{SC}}$$

$$= \frac{7.089}{6.034m}$$

= 1.175kΩ

In figure 4,

$$I_L = \frac{7.089}{1.175K + 1K}$$

= 3.26mA

V_L = 3.26mA×1kΩ = 3.26V

2. Compare the measured values and the calculated values from step 1 and comment on any observed discrepancy.

<u>Answer:</u>

Since this is not actual lab this is a simulation, so there is no discrepancy between the measured values and the calculated value. But in reality there would be a discrepancy because that time temperature and depends circuit connection the value will be some change.

3. Using PSpice, simulate the circuit of Figure 1 and determine V_L and I_L. Simulate the circuit of Figure 2 and determine V_{OC}. For this purpose, connect a 0A current source between nodes a and b. Simulate the circuit of Figure 3 and determine I_{SC}. For this purpose, connect a 0Vvoltage source between nodes a and b. Determine the values of E_{th} and R_{th}. Simulate the circuit of Figure 4 and determine V_L and I_L. Verify the Thevenin's theorem from simulated data.

Answer:

Using PSpice, simulate the circuit of Figure 1 and V_L = 3.26V and I_L =3.26mA. Simulate the circuit of Figure 2 and this time we get V_{OC} = 7.090V. For this purpose, we connect a 0A current source between nodes a and b. Simulate the circuit of Figure 3 and get I_{SC} =6.034mA. For this purpose, we connect a 0Vvoltage source between nodes a and b. The values of E_{th} =7.090V and R_{th} =1.175KΩ. Simulate the circuit of Figure 4 and get V_L =3.26V and I_L = 3.26mA. Pspice simulation data match into the Thevenin's theorem.

Discussion:

In Thevenin equivalent resistor at different times we need different value resistor. So if we use a decade resistance box then we can make easily any kind of resistance value. We just simply connect the decade resistance box into our circuit then we set the value of resistance, actually, the decade resistance box helps us to make any kind of resistance into the circuit.

our circuit.

Figure 5.Decade Resistance Box

Suppose we want to make 1.427kΩ or 1427Ω resistance then we need to turn on a few switches into our decade resistance box those are 1kΩ=1000Ω, 400Ω, 20Ω, 4Ω, 3Ω or (1000+400+200+4+3) Ω =1427 ohm and now we get our resistance value what we need into our circuit.

Conclusion:

In experiment 6, we calculate Thevenin equivalent circuit theoretically and using PSpice simulation. In our actual lab, we use a decade resistance box to get value in the resistance into our circuit but in PSpice, we don't need it. Now we know how to work Thevenin's equivalent circuit and this circuit made our life easy. If we know Voltage and Resistance in a complex circuit then we make a simple series of Thevenin's equivalent circuit, so it is very easy to make simple series circuit.