EAST WEST UNIVERSITY

Department of Computer Science and Engineering

Course Title: Electrical Circuits

Course Number: 209

Semester: 4^{th}

Experiment No.: 06

Experiment Title: Verification of Thevenin's theorem.

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Date of Performance: 23-12-21

Date of Report Submission: 07-01-22

Objectives:

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

Circuit Diagram:

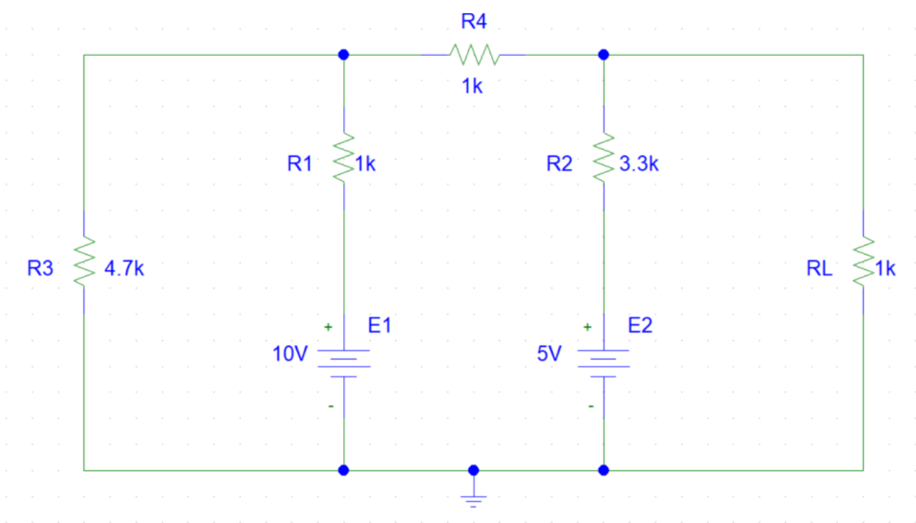

Figure - 1: Circuit whose Thevenin's equivalent to be determined

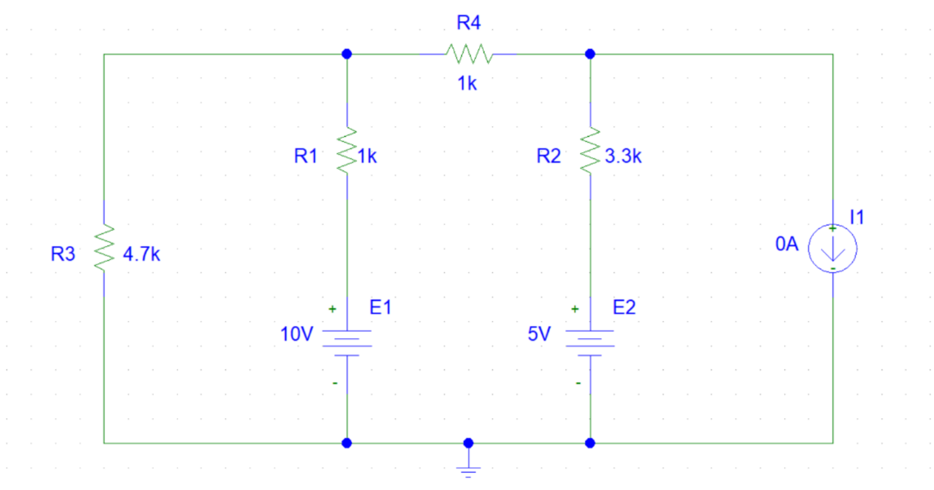

Figure - 2: Circuit to measure the open-circuit voltage

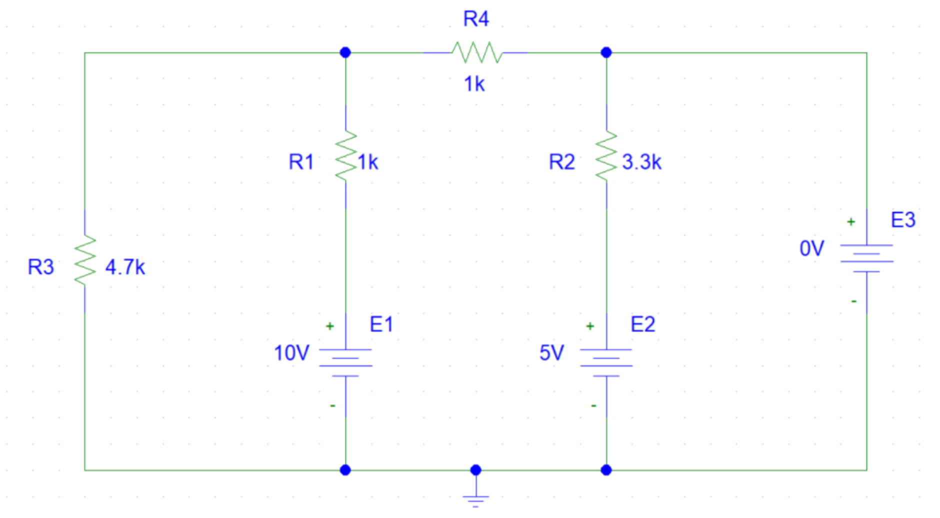

Figure - 3: Circuit to measure the short-circuit current.

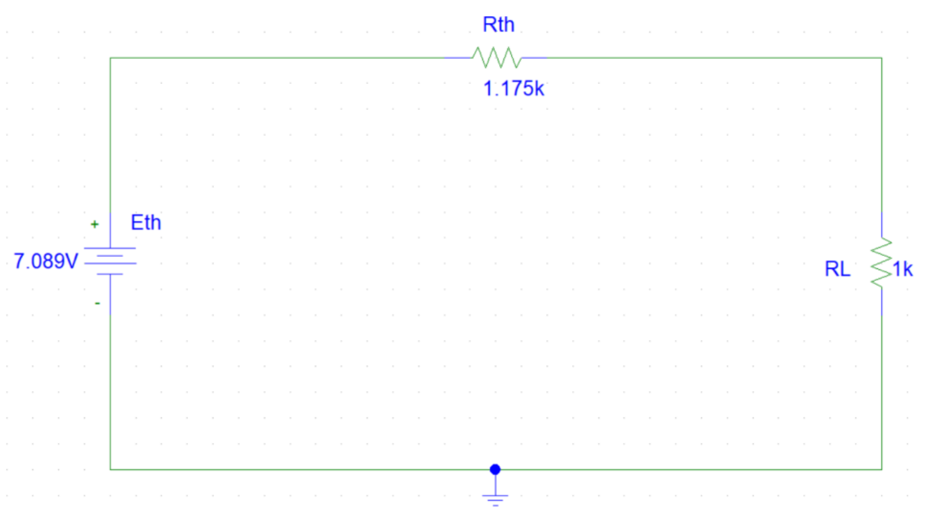

Figure - 4: Circuit to verify Thevenin's theorem

Table 01. 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 (k)
10	5	3.260	3.260	7.090	6.034	$R_1 = 1$, $R_2 = 3.3$, $R_3 = 4.7$, $R_4 = 1$, $R_L = 1$

Table 02. Experimental-datasheet for Thevenin's equivalent circuit

$V_{OC} = E_{Th}$ (V)	$R_{Th} = V_{OC} / I_{SC}$ (k-ohm)	Measured Value of V_L (V)	Measured Value of I_L (mA)
7.090	1.175	3.259	3.259

Answer to the question of post lab report 01:

From figure - 1:

Applying KVL on

mesh - 1,

$4.7i_1 + i_1 - i_2$

$+ 10 = 0$

$5.7i_1 - i_2 = - 10$ … … … (1)

Applying KVL on mesh - 2,

$- 10 + i_2 - i_1 + i_2 + 3.3i_2 - 3.3i_3 - 5 = 0$

$- i_1 + 5.3i_2 - 3.3i_3 = 5$ … … … (2)

Applying KVL on mesh - 3,

$-5 + 3.3i_3 - 3.3i_2 + i_3 = 0$

$- 3.3i_2 + 4.3i_3 = 5$ … … … (3)

Solving (1), (2) & (3) -

$i_1 = 1.27 mA$
$i_2 = 2.733 mA$
$i_3 = 3.260\ mA = I_L$

So, $V_L = I_L R_L = (3.260 \times 1)V = 3.260\ V$

From figure - 2:

Applying KVL on
mesh - 1,
$4.7i_1 + i_1 -$
$i_2 = -10$
$5.7i_1 - i_2 = -10$ … … … (1)

Applying KVL on mesh - 2,
$-10 + i_2 - i_1 + i_2 + 3.3i_2 = -5$

$-i_1 + 5.3i_2 = 5$ … … … (2)

Solving (1) & (2) –

$i_1 = -1.643\ mA$
$i_2 = 0.633\ mA$

So, $V_{OC} = (3.3 \times 0.633) + 5 = 7.089\ V = E_{th}$

From figure - 3:

Applying KVL on
mesh - 1,
$4.7i_1 + i_1 -$
$i_2 = -10$
$5.7i_1 - i_2 = -10$ … … … (1)

Applying KVL on mesh - 2,
$-i_1 + 5.3i_2 - 3.3i_3 = 5$ … … … (2)

Applying KVL on mesh - 3,

$-3.3i_2 + 3.3i_3 = 5$ … … … (3)

Solving (1), (2) & (3) -

$i_1 = -0.962$ mA

$i_2 = 4.519$mA

$i_3 = 6.034$ mA $= I_{SC}$

So, $R_{Th} = V_{OC} / I_{SC} = (7.089 / 6.034)$ohm $= 1.175$ k-ohm

From figure - 4:

$I_L = V_{OC} / (R_{Th} + R_L)$

$= 7.089 / (1.175+1)$

$= 3.259$ mA

$V_L = I_L R_L = 3.259 \times 1 = 3.259$ V

So, the Thevenin's theorem verified.

Answer to the question of post lab report 02:

The theoretical solution of the circuit and solution obtained from PSpice is the same.

Answer to the question of post lab report 03:

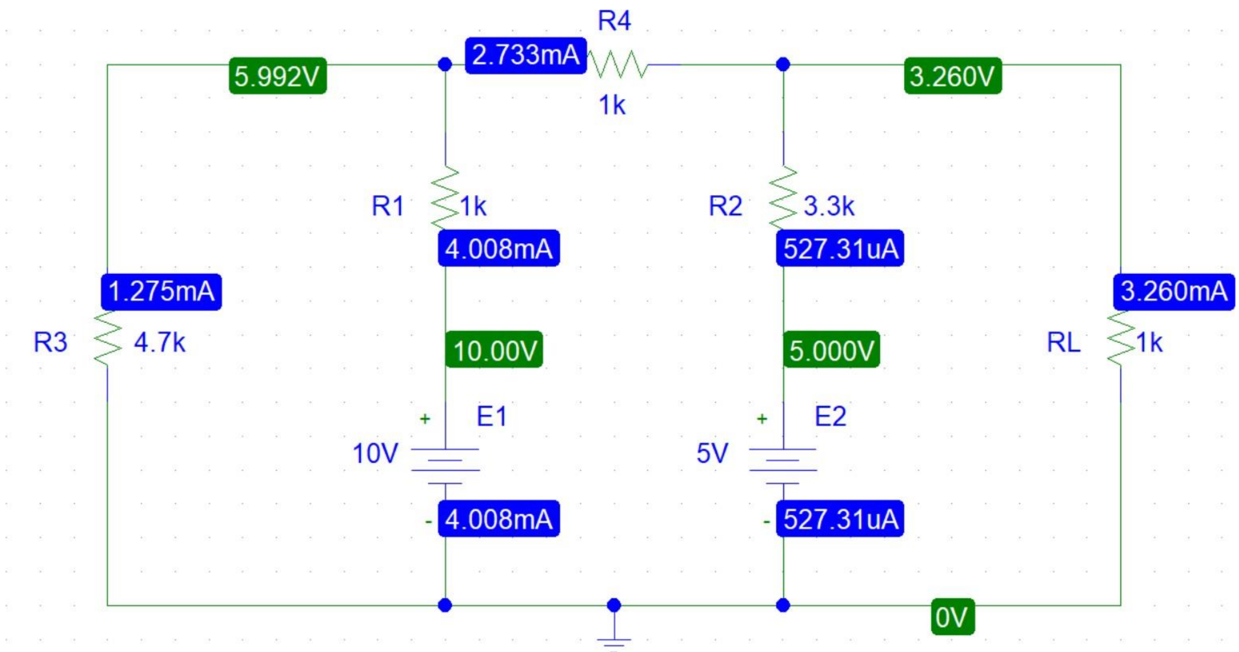

Figure - 5: Circuit whose Thevenin's equivalent to be determined

From figure - 5,

V_L = 3.260 V

I_L = 3.260 mA

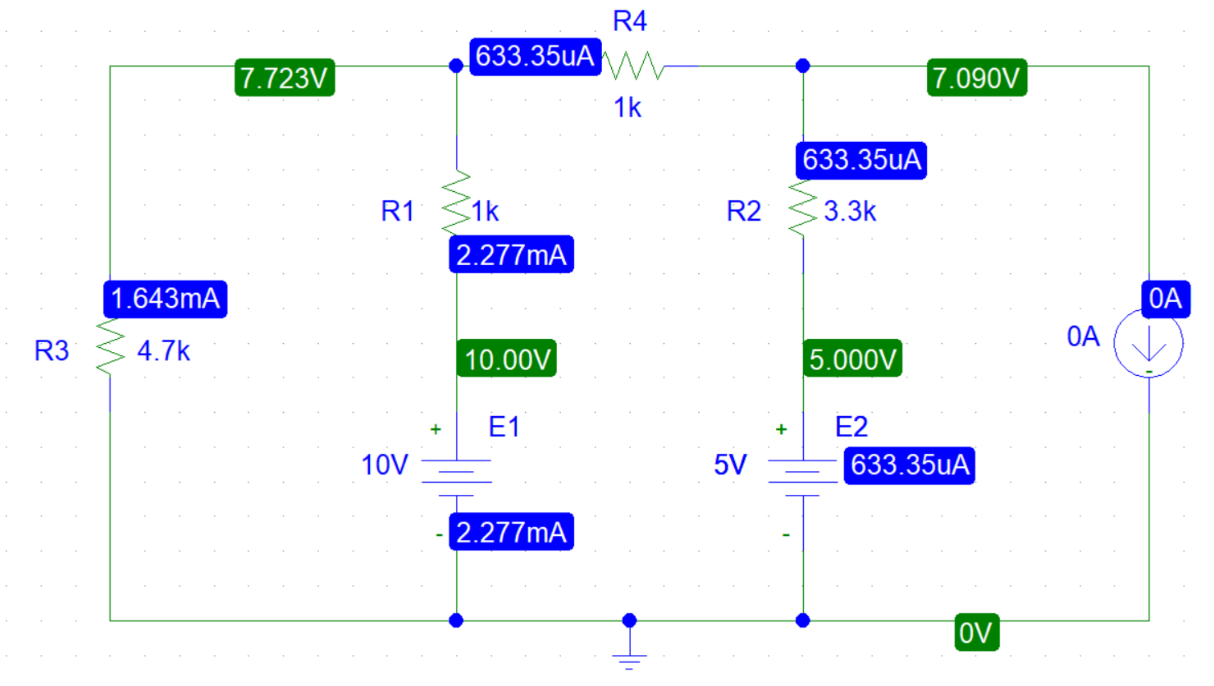

Figure - 6: Circuit to measure the open-circuit voltage

From figure - 6,

$V_{OC} = 7.090$ V

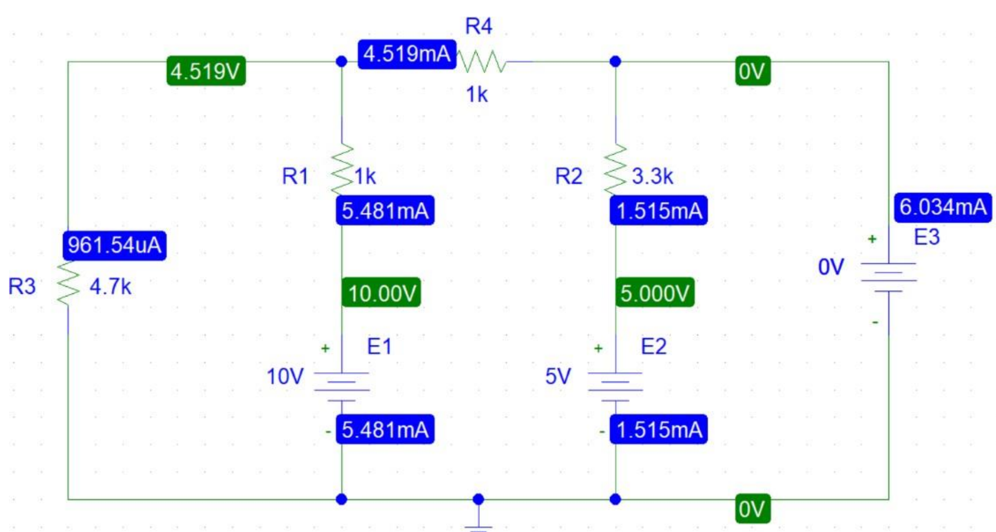

Figure - 7: Circuit to measure the short-circuit current

From figure - 7,

I_{SC} = 6.034 mA

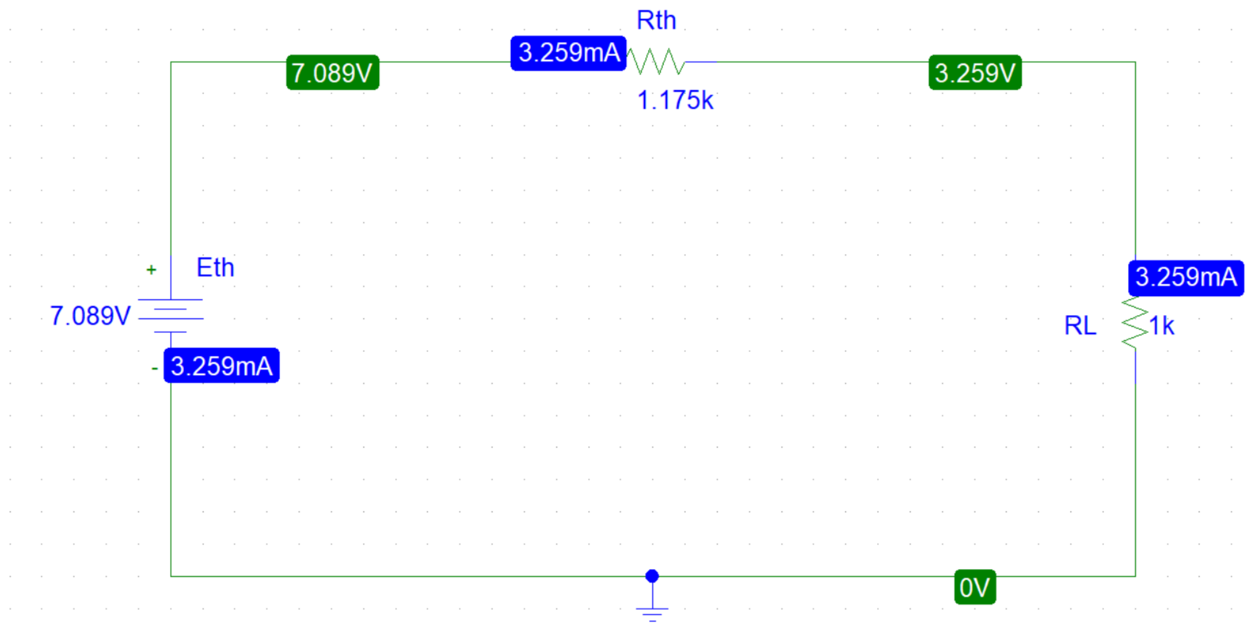

Figure - 8: Circuit to verify Thevenin' theorem.

From figure - 8,

V_L = 3.259 V

R_L = 3.259 mA

Conclusion:

In this experiment, we learn the verification of Thevenin's theorem. Then, compared the theoretical values with experimental values & found frictional discrepancy.