



University of California Merced  
School of Engineering  
Department of Electrical Engineering

**ENGR 065 Circuit Theory**

**Lab #5 : Thevinin Equivalent Circuit**

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**Section**

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## Objectives

- Verify Thevinin Equivalent Circuits
- Find the equivalent resistance of a circuit.
- Measure the currents and voltages within the circuit.

## Introduction:

In this lab, students will verify the Thevinin Equivalent Circuit. This will be done by first, calculating the theoretical voltage and resistance of a given circuit schematic. Next, these theoretical calculations will be compared to the measured values of the physical circuit. Then, the Thevinin equivalent circuit will be constructed and measured. Lastly, both results will be compared to prove the law.

## Procedure:

### Part 1

Using the given electrical lab equipment, construct the circuit below (figure a) with  $R_1 = 470\Omega$ ,  $R_2 = 1k\Omega$ ,  $R_3 = 5.6k\Omega$ ,  $R_4 = 3.3k\Omega$ ,  $R_5 = 2.2k\Omega$  and  $R_{Load} = 680\Omega$ . Then fill out a data table with the theoretical (calculated) values of  $V_{ab}$ ,  $R_{th}$ (equivalent resistance of the circuit), and  $V_{th}$  (voltage seen without the load). Now, measure the voltage across and the current flowing through the load resistor. Enter the measured values in a data table.

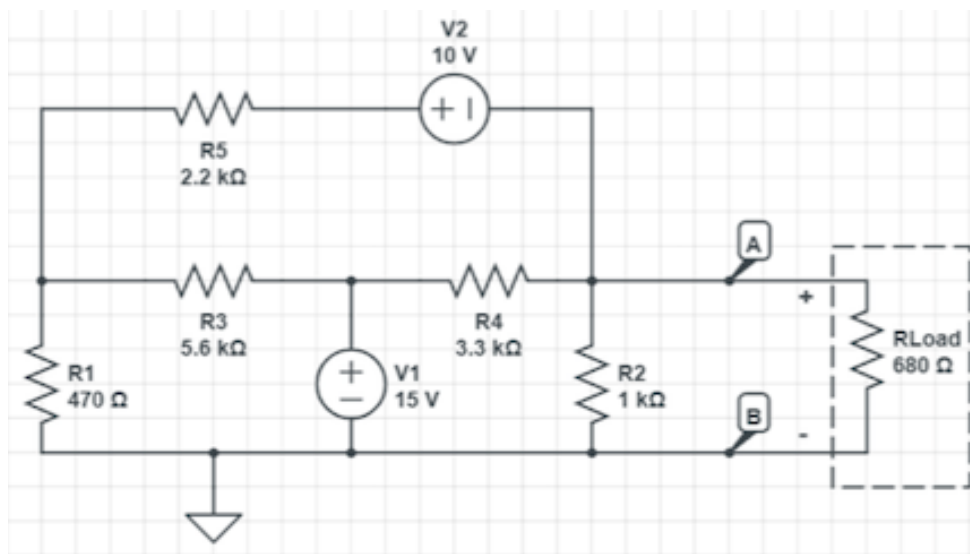


Figure A

## Part 2

To measure the Thevinin voltage and the Thevinin resistance, remove the load resistor. Measure the voltage where the load resistor previously was. Now remove the voltage sources and replace with short circuits (wires). These are the Thevinin values.

## Part 3

Now that the Thevinin values are known. Construct the Thevinin circuit by using a potentiometer dialed to be the same resistance as the Thevinin and provide the Thevinin voltage by adjusting the power supply.

## Part 4

Measure the voltage across the load resistor attached to the newly constructed circuit as well as the current flowing through it. Compare your results to that of the original circuit and calculate the percent error.

### Data and Measurements:

	Theoretical Value*	Measured Value
Voltage $v_{AB}$	0.4V	0.387
Current (in the load resistance $R_{Load}$ )	0.67 mA	0.52 mA

	Theoretical Value*	Measured Value
Voltage $v_{AB} = V_{Th}$	0.456 V	0.725

	Theoretical Value*	Measured Value
$R_{Th}$	594.3 $\Omega$	587 $\Omega$

## **Analysis**

When measuring the voltage and the current across the load resistor, the measurements were close to our theoretical values but there were some discrepancies. This could have been due to the fact that we don't have an "idea" voltmeter or ammeter in real life. Another problem could have been not using enough significant digits in our calculations.

## **Conclusion**

All the objectives for this lab were thoroughly covered. From calculating theoretical values and then verifying with real world measurements, the Thevinin Equivalent Circuit was effectively verified.