ENGR 065 Circuit Theory

Laboratory 5
Thévenin Equivalent Circuit

Objectives

- Understand and verify Thévenin equivalent circuit

Equipment and components

- 2x Digital multimeter
- 2x Power supply
- Breadboard
- Cables and connecting wires as needed
- Resistors: 470 Ω, 680 Ω, 1 kΩ, 2.2 kΩ, 3.3 kΩ, 5.6 kΩ
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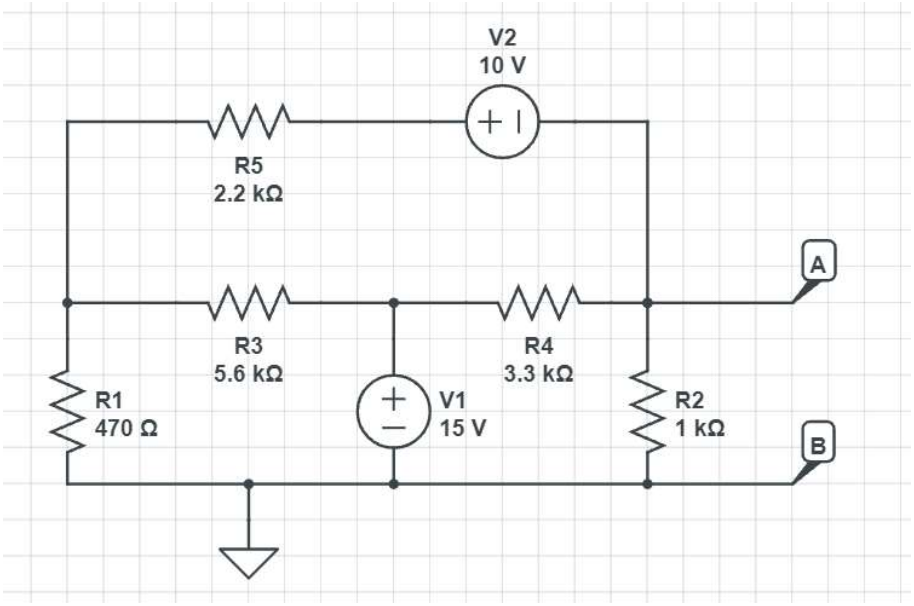
Preliminary Work

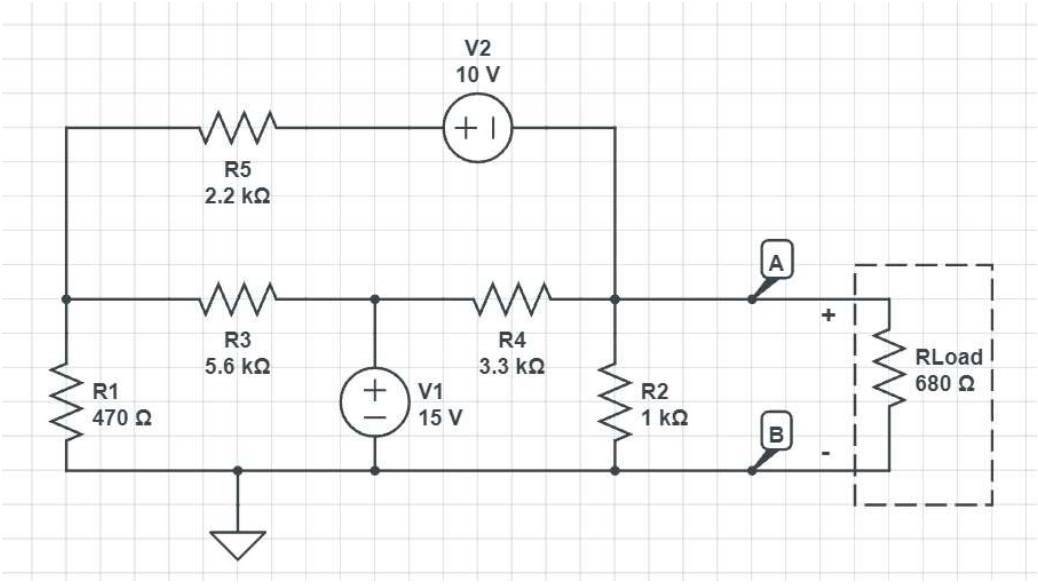
- Read chapter 4 of the textbook.
- Find the Thévenin equivalent circuit (i.e., Thévenin voltage V_{Th} and Thevenin resistance R_{Th}) to the left of terminals A,B



  Staple the pre-lab results and calculations to this handout. Clearly indicate units for your solutions.
- Show your pre-lab results to your instructor before starting the lab.

Procedure

1. The purpose of this lab is to find and verify the Thévenin equivalent for the portion of the circuit with points A and B left open (i.e., to the left of terminals A,B). Once the equivalent circuit is found, it will be built with the 680 Ω load attached. The voltage across and current through the load for both circuits need to be compared.



2. Build the circuit above and measure the voltage across and the current flowing through the load. Compute also the expected theoretical values based on the Thévenin equivalent circuit (which was obtained during preliminary lab work)

	Theoretical Value*	**Measured Value**
Voltage v_{AB}	337.18 mV	375 mV
Current (in the load resistance $RLoad$)	554.68 uA	464 uA

3. We will know measure the Thévenin voltage V_{Th} and Thevenin resistance R_{Th}.

- Remove the load resistor of 680 Ω and then measure v_{AB} across the points A and B. The measured voltage is the Thévenin voltage V_{Th}.

	Theoretical Value*	**Measured Value**
Voltage $v_{AB} = V_{Th}$	706.82 mV	698 mV

- With the load still removed, replace the voltage sources with short circuits (wires). Measure the resistance across the points A and B to find the Thévenin resistance R_{Th}.

	Theoretical Value*	**Measured Value**
R_{Th}	594.27 ohms	586 ohm

4. Knowing V_{Th} and R_{Th}, construct a series circuit with a voltage source with the value of V_{Th}, a resistor with the value of R_{Th} and the load resistor $R_L = 680\ \Omega$. You may have to use the potentiometer for the resistor of R_{Th} because you may not be able to find R_{Th} using the provided resistors.

   • Measure the voltage across and current flowing through the load resistor of $680\ \Omega$.

   Voltage = 698 mV
   Current = 400 uA

5. Calculate the percent difference between the voltage and current for the two circuits (i.e., original circuit *vs* equivalent circuit). Explain the difference.

   Voltage % difference = 1.13%
   Current % difference = 27.798 %

6. **Clean up and put everything in their original places before leaving labs!**