ECET 102/CPET 101
LAB 8
Source Conversion and Superposition Lab

Required Devices and Equipment

Resistors: 1k, 2.2k, 3.3k

Objectives:

1. Calculate circuit voltages and currents using the method of source conversion
2. Measure circuit voltages and currents and verify the results of the source conversion calculations
3. Calculate circuit voltages and currents using the superposition method.
4. Measure circuit voltages and currents and verify the results of the superposition calculations

General Information:

You have combined resistors in series and parallel to analyze circuits. This method only works for relatively simple circuits. Source conversion and superposition are two additional methods of circuit analysis that can be used with circuits like that of Figure 1, below. The circuit of Figure 1 cannot be analyzed by just combining resistors in series and parallel.

Procedure:

Part 1: Source Conversion Calculations and Circuit Measurements

For the circuit shown in Figure 1:

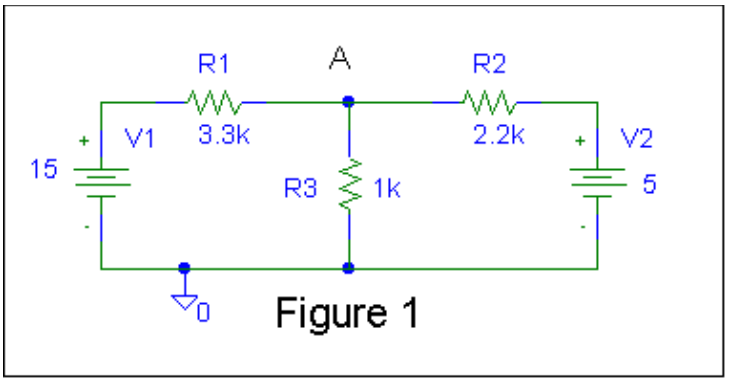

Figure 1

a. Calculate the voltage at node A and the current through each resistor *using source conversion*. Show your work and write the calculated values below:

V_A = _____

$I_{3.3k}$ = _____ I_{1k} = _____ $I_{2.2k}$ = _____

Indicate the direction of each current on the circuit diagram

Show work here:

b. Construct the circuit, measure the same voltage and currents and write the measured values below:

Measured values: V_A = _____

$I_{3.3k}$ = _____ I_{1k} = _____ $I_{2.2k}$ = _____

c. Discuss the reasons for differences between measured and calculated values.

Part 2: Superposition:

a. The circuit shown in Figure 2 is the circuit of Figure 1 with the 5-volt battery replaced with a short circuit. For the circuit in Figure 2:

Use series-parallel conversion to calculate the Voltage at node A1 and the current through each resistor. Show your work and write your calculated values below.

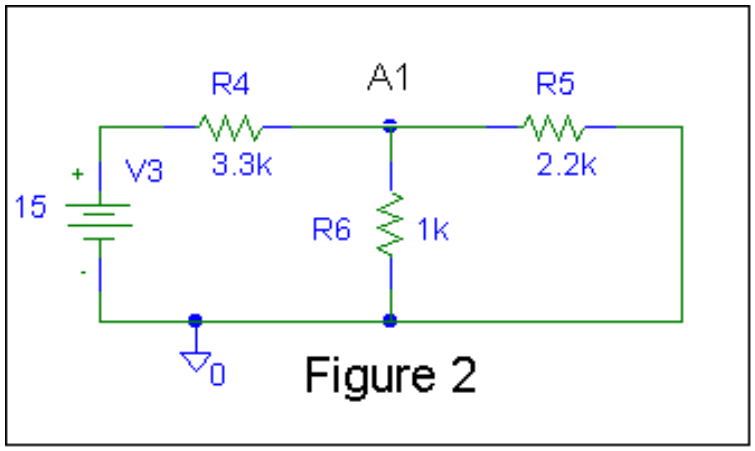

Figure 2

Calculated values: V_{A1} = _____

$I1_{3.3k}$ = _____ $I1_{1k}$ = _____ $I1_{2.2k}$ = _____

Ensure that the sign of each current corresponds to the actual current direction from part 1a. If the current is in the same direction as part 1a use a + sign and if the current is in the opposite direction from part 1a use a - sign.

Construct the circuit, measure the Voltage at node A1 and all three currents (include direction) and write the measured values below:

V_{A1} = _____

$I1_{3.3k}$ = _____ $I1_{1k}$ = _____ $I1_{2.2k}$ = _____

b. For the circuit shown in Figure 3:

Use series-parallel conversion to calculate the Voltage at node A2 and the current through each resistor. Show your work and write your calculated values below.

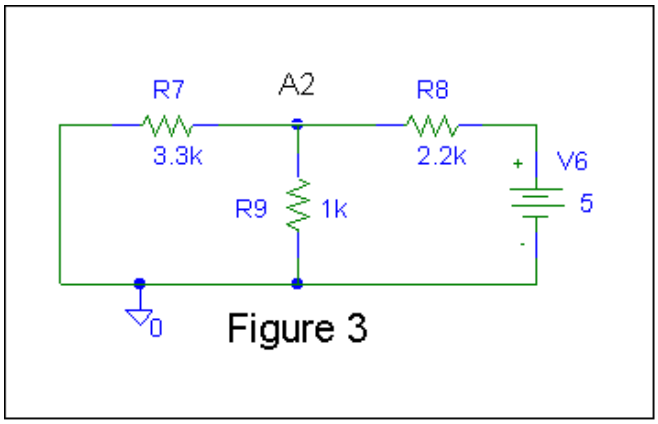

Figure 3

Calculated values:

V_{A2} = _____

$I2_{3.3k}$ = _____ $I2_{1k}$ = _____ $I2_{2.2k}$ = _____

Ensure that the sign of each current corresponds to the actual current direction from part 1a. If the current is in the same direction as part 1a use a + sign and if the current is in the opposite direction from part 1a use a - sign.

Construct the circuit, measure the Voltage at node A2, and all three currents (include direction) and write the measured values below:

V_{A2} = _____

$I2_{3.3k}$ = _____ $I2_{1k}$ = _____ $I2_{2.2k}$ = _____

c. Verify the Superposition theorem using the following calculations:

(Ensure you use the correct sign)

Calculated:

$V_A = V_{A1} + V_{A2}$ _____ = _____ + _____

$I_{3.3k} = I1_{3.3k} + I2_{3.3k}$ _____ = _____ + _____

$I_{2.2k} = I1_{2.2k} + I2_{2.2k}$ _____ = _____ + _____

$I_{1k} = I1_{1k} + I2_{1k}$ _____ = _____ + _____

Measured:

$V_A = V_{A1} + V_{A2}$ _____ = _____ + _____

$I_{3.3k} = I1_{3.3k} + I2_{3.3k}$ _____ = _____ + _____

$I_{2.2k} = I1_{2.2k} + I2_{2.2k}$ _____ = _____ + _____

$I_{1k} = I1_{1k} + I2_{1k}$ _____ = _____ + _____

c. Do the above results verify the superposition theorem? Explain.

d. Which method of calculation **(**Source Conversion or Superposition) is easier to understand and to perform calculations? Please explain.

Part 3: Problem

For the circuit shown in Figure 4, calculate the voltage at node A and the currents through all of the resistors. Use either the Source Conversion or Superposition method of analysis. Show your work and write the values below.

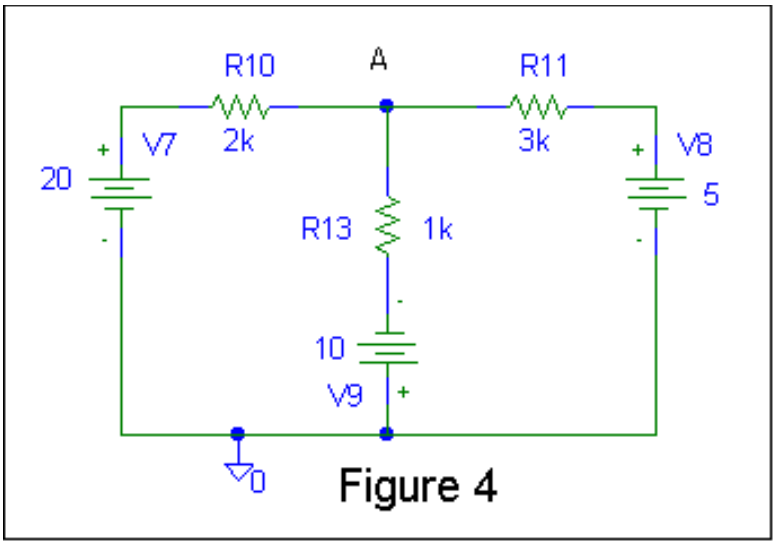

Figure 4

V_A = _____

I_{2k} = _____ I_{3k} = _____

Indicate the direction of each current on the circuit diagram

Show work here: