ECE 541: Electric Circuits

Laboratory Exercise #2

Weeks of 10/03/22 (Group A) and 10/10/22 (Group B)

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Objective

To introduce the student to construct and analyze voltage and current divider **circuits**.

Voltage Divider Circuit

1. Connect the series circuit as shown in Figure 1

$\frac{5}{7,800} = 0.64$ mA

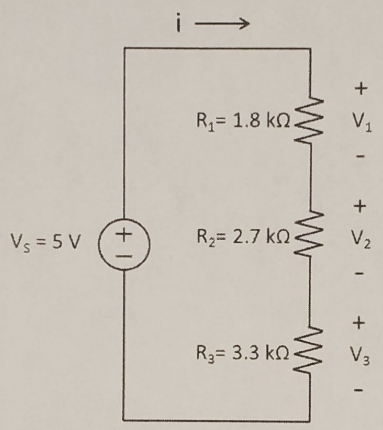


Figure 1: Series Circuit

2. (Pre-Lab) Use voltage division principle to calculate the voltages V1, V2, and V3 in figure 1 (show your calculations).

$0.64 \cdot 1.8 = 1.15$ $0.64 \cdot 2.7 = 1.73$

$0.64 \cdot 3.3 = 2.12$

V1: 1.15 V2: 1.73 V3: 2.12

3. (Pre-Lab) Calculate the current in figure 1 (show your calculations).

$R_{eq} = 7800\Omega$

$\frac{V}{R} \rightarrow \frac{5}{7800} = 0.64mA$

i: 0.64mA

4. Measure the actual value of the three resistors in the circuit:

R1: 1.76 kΩ R2: 2.69 kΩ R3: 3.25

5. Measure the voltage between the nodes in the circuit:

V1: 1.15 V2: 1.75 V3: 2.11

6. Measure the current through the resistors in the circuit:

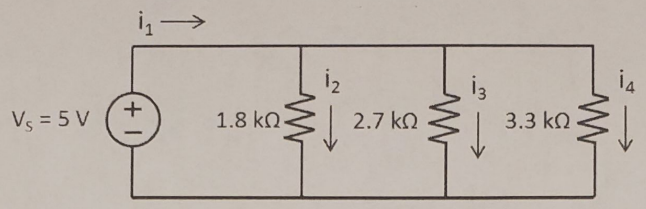
i: 0.64mA

7. Do the measured voltage and current values agree with the theoretical values according to Ohm's Law and the voltage divider rule? Which resistor has the largest voltage drop across it?

yes the most resistive resistor (3.3 kΩ) has the largest voltage drop across it

Current Divider Circuit

1. Connect the parallel circuit as shown in Figure 2.



$R_{eq} = 613.7\,\Omega$

Figure 2. Parallel Circuit

2. (Pre-Lab) Using the current division principle, calculate each current in figure 2 (show calculations).

6.1mA 2.7mA

I1: [illegible] I2: [illegible] I3: 1.85mA I4: 1.51mA

3. (Pre-Lab) What is the expected voltage across each of the resistors?

5V

4. Measure the currents in the parallel circuit. Make sure to connect the multimeter in series with each resistor.

I1: 6.21mA I2: 2.68mA I3: 1.79mA I4: 1.99mA

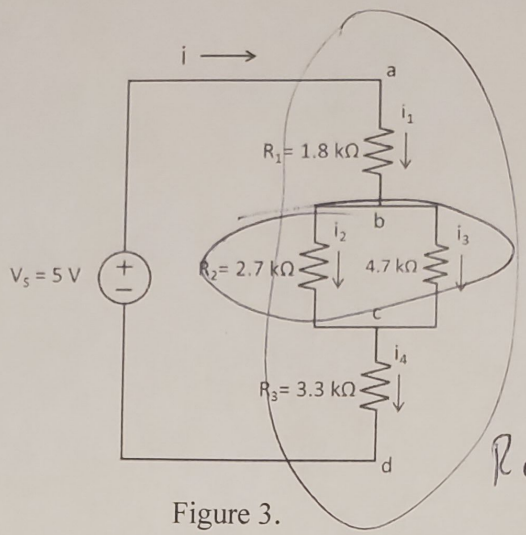
5. Do the measured values of the current match the calculated ones?

yes, pretty close

Series and Parallel Circuit

1. Connect the series and parallel circuit as shown in Figure 3.

$V_{R_1} = 1.32\text{v}$



$Req_1 = 4,714.4\ \Omega$

$Req_2 = 6814.9\ \Omega$

Figure 3.

2. (Pre-lab) Calculate the currents in the circuit (show calculations). Use the measured values of the resistors.

$5 - 1.32 = 3.68\text{v}$

$i_1 = i_4 = \frac{5}{6815} = 0.73\text{mA}$

$\frac{3.68}{2700} = 1.36\text{mA}$

$1800 + \frac{1}{\frac{1}{2700} + \frac{1}{4700}} + 3300 = 6815\ \Omega$

$\frac{3.68}{4700} = 0.78\text{mA}$

$I_2 2700 = I_3 4700$

$\frac{3.68}{715} = 2.15\text{mA}$

0.46mA 0.27mA

I1: 0.73mA I2: _____ I3: _____ I4: 0.73mA

3. (Pre-Lab) Calculate the voltages between the nodes in the circuit (show calculations). Use the measured values of the resistors.

$V=IR$

$0.73mA \cdot 1800\Omega$

$0.73mA \cdot 3300\Omega$

$0.73mA \cdot 1715\Omega$

$0.73mA \cdot 6815\Omega$

Vab: 1.32v Vbc: 1.25v Vcd: 2.41v Vad: 4.97v

4. Measure the currents in the circuit (Make sure to connect the multimeter in series):

I1: 0.73mA I2: 0.46mA I3: 0.27mA I4: 0.73mA

5. Measure the voltages between nodes in the circuit:

Vab: 1.31v Vbc: 1.27v Vcd: 2.42v Vad: 5.01v

6. Do the calculated values of current and voltage match the measured values of current and voltage?

yes, pretty close