Name: _____

ECET 231 – Circuit Analysis I

Lab 3
Series DC Circuits

Objective: Students successfully completing this lab will accomplish the following objectives:
1. Gain understanding of the application of Kirchhoff's Voltage Law (KVL).
2. Increase familiarity with the relationships between voltage, current and resistance in a series circuit.
3. Learn to analyze series circuits and verify theoretical results with characteristic measurements.

Lab Report: A combined formal lab report will be required for lab exercises 2, 3 and 4. Reports will be due one week after lab 4 has been performed. All lab handouts complete with tabulated data and calculations should be added as attachments to your formal report.

Equipment: Assigned resistors (from pre-lab 3), Digital Multimeters (DMMs, 2), connecting leads, alligator clips, breadboard and jumper wires.

Procedure:

1. Record the color codes and tolerances of the resistors that were assigned to you in the pre-lab exercise. Measure the values of each of these resistors and calculate the percent error. Record this information in table 1 below.

Table 1: Nominal and measured resistor values.

#	Color Code Resistance	Measured Resistance	Tolerance (%)	%Error	Within Tolerance? (Y or N)
R1					
R2					
R3					

2. Using your assigned resistors, connect the series circuit shown in Figure 1 below. Connect one DMM to the voltage of the power supply and another to measure the loop current. Have the instructor check the circuit before applying power. Set the power supply to 12 V.

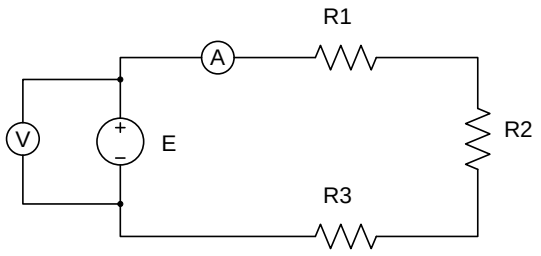

Figure 1: Series circuit with three resistors.

3. Perform the following measurements and calculations. Record your results in table 2.
   - Measure the total current, voltage and resistance of the series circuit.
   - Measure the three resistor voltages (V_1, V_2 and V_3).
   - Measure the voltage across R1 and R2 combined (V_{R1R2}).
   - Measure the voltage across R2 and R3 combined (V_{R2R3}).
   - Calculate the total power applied to the circuit (P_T) and the power dissipated by each resistor (P_1, P_2, and P_3).

Table 2: Electrical quantities in a series circuit with a 12 V source.

	Measured Quantities			Calculated Power (show calculation)
	Voltage	**Current**	**Resistance**	
Total				
R1				
R2				
R3				
R1, R2 Combined				
R2, R3 Combined				

4. In your lab report, answer each of the following questions:

   - Do the resistor voltages add up to the power supply voltage?
   - Do the resistor voltages V_1 and V_2 add up to the combined voltage V_{R1R2}?
   - Do the resistor voltages V_2 and V_3 add up to the combined voltage V_{R2R3}?
   - Do the powers dissipated in the resistors add up to the applied power?

5. Decrease the applied voltage to 10 V. Measure the circuit current and resistor voltages. Calculate the power supplied to the circuit. Record your results in table 3 below.

Table 3: Electrical quantities in a series circuit with a 10 V source.

Quantity	Value
I	
V_1	
V_2	
V_3	
P_T	

6. In your lab report, answer each of the following questions. When the supply voltage is decreased from 12 V to 10 V:

   - What is the effect on circuit current?
   - What is the effect on the resistor voltages?
   - What is the effect on the power supplied to the circuit?
   - Does the total voltage still equal the sum of the individual resistor voltages?

7. Remove one of the resistors (R3) and reconnect the circuit as shown in figure 2 below. Set the power supply to 12 V.

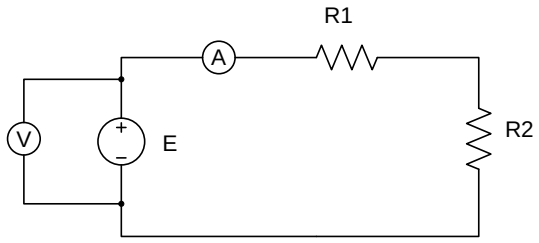

Figure 2: Series circuit with two resistors.

8. Measure the circuit current and resistor voltages. Calculate the power supplied to the circuit. Record your results in Table 4 below.

Table 4: Electrical quantities in a reduced series circuit with a 12 V source.

Quantity	Value
I	
V_1	
V_2	
P_T	

9. In your lab report, answer each of the following questions. When reducing a series circuit with a 12 V source and three resistors to only two resistors:

- What is the effect on circuit current?
- What is the effect on the resistor voltages V1 and V2?
- What is the effect on the total power supplied to the circuit?
- Does the total voltage still equal the sum of the individual voltages?

10. Draw conclusions from this lab exercise regarding the behavior of series circuits. Include these conclusions in your lab report.

- What do the resistor voltages in a series circuit add up to?
- What do the powers dissipated by resistors in a series circuit add up to?
- When the total resistance in a series circuit is *decreased*, what is the effect on circuit current and applied power?
- When the total resistance in a series circuit is *increased*, what is the effect on circuit current and applied power?
- When the supply voltage in a series circuit is increased, what is the effect on the circuit current, resistor voltages, applied power and power dissipated in each resistor?