**Name**_____ **Lab Section**_____ **Date**_____

INTRODUCTION:

In this lab Mesh Circuit Analysis will be applied to a complex circuit. The circuit shown in Figure 5.1 is a circuit with two voltage sources and resistor branches that are neither in series or parallel. The key concept of Mesh analysis is to write KVL equations for each panel of a network circuit in a clockwise (or counter-clockwise) direction avoiding current sources. It is important to distinguish the mesh current from the branch current. The branch current is the only one that can be measured.

PRELAB:

1. Use Mesh Circuit Analysis to solve for all voltages and currents in the circuit shown in Figure 5.1 using the following circuit parameters:

$$V_1=15V, \ V_2=5V, \ R_1=1k\Omega, \ R_2=10k\Omega, \ R_3=510\Omega, \ R_4=2k\Omega, \ R_5=3.6k\Omega, \ R_6=100\Omega$$
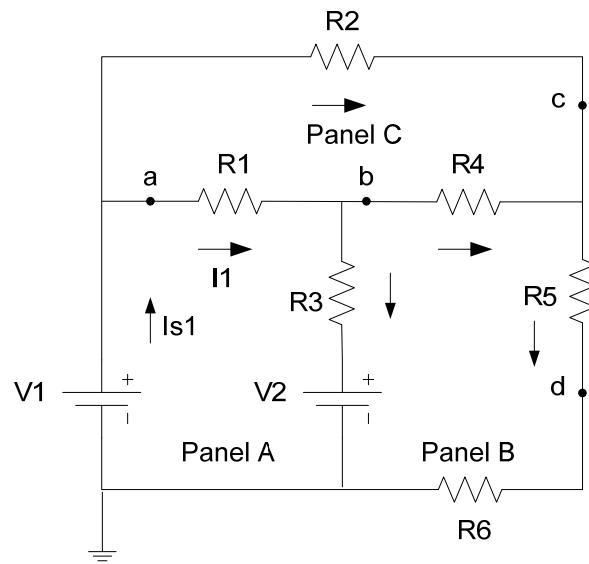
Figure 5.1: Network circuit.

2. Write Mesh equations in the clock-wise direction for each circuit panel in the space below using the subscripts A, B, and C for the mesh currents:

I_A Mesh Equation: _____

I_B Mesh Equation: _____

I_C Mesh Equation: _____

3. Solve the set of mesh equations for the mesh currents and record the results below:

$I_A =$ _____ $I_B =$ _____ $I_C =$ _____

4. Use the mesh currents to calculate the branch currents, the voltage across each resistor, and voltage at each node. Record the answers in Tables 5.1 and 5.2.

PROCEDURE:

1. Use the Agilent 34401A multimeter to measure all resistors. Record the values in Table 5.3.

2. Construct on the protoboard the circuit shown in Figure 5.1. Two voltage sources will be needed. One source will be set to 15.0V and the other to 5.0V. If the lab bench has the Agilent E3612A, two will be needed. If the bench has the Agilent E3630A, use the 0-6V output and the 0-18V output. It might be necessary to set one supply at 5V then the other supply at 10V and connect the two in series. Ask your instructor to verify your connections.

3. Using a multimeter, measure the source voltages V_1 and V_2, the node voltages, the voltage across each resistor, and the branch current flowing through each resistor (remember to break the circuit when measuring current). Record the measured values in Tables 5.4 and 5.5.

4. Use the computer at your lab station to run PSpice. Build the circuit in PSpice using the measured voltages for each source and using the measured resistor values. Once simulated (F11), use the V and I buttons to display the voltage and currents at each node. Print the schematic and record the voltage and currents in Tables 5.6 and 5.7.

ANALYSIS:

1. Calculate the relative difference (% error) between the nominal prelab calculated values of Tables 5.1 and 5.2 to the measured values of Tables 5.4 and 5.5 for all voltages and currents. Tabulate the results. Comment on the comparison and probable cause of errors.

2. Calculate the relative difference (%error) between the measured values of Tables 5.4 and 5.5 to the PSpice values of Tables 5.6 and 5.7 which were generated using all measured components. Tabulate the results. Comment on the comparison and probable cause of errors.

SUBMISSION REQUIREMENTS:

Use the Data Tables page as a cover sheet and staple to the back of it (in the specified order):

1) Your hand calculations showing the work you performed in order to complete the prelab.
2) A printout of the PSpice simulation showing the required node voltages and branch currents.
3) A page showing the results of the relative difference error analysis.

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<u>**PRELAB CALCULATIONS:**</u>

Table 5.1: Prelab Calculation of Voltages and Current of each Resistor

	R_1=1 kΩ	R_2=10 kΩ	R_3=510 Ω	R_4=2 kΩ	R_5=3.6 kΩ	R_6=100 Ω
V_{Rn}						
I_{Rn}						

Table 5.2: Prelab Calculated Node Voltages and Select Current

V_a	V_b	V_c	V_d	I_{s1}

<u>**MEASURED DATA:**</u>

Table 5.3: Measured Resistor Values

Resistance	R_1=1 kΩ	R_2=10 kΩ	R_3=510 Ω	R_4=2 kΩ	R_5=3.6 kΩ	R_6=100 Ω
Measured						

Table 5.4: Measured Resistor Voltages and Currents

	R_1=1 kΩ	R_2=10 kΩ	R_3=510 Ω	R_4=2 kΩ	R_5=3.6 kΩ	R_6=100 Ω
V_{Rn}						
I_{Rn}						

Table 5.5: Measured Node Voltages and Select Currents

V_1	V_2	V_a	V_b	V_c	V_d	I_{s1}

<u>**PSPICE RESULTS:**</u>

Table 5.6: PSpice Simulated Node Voltages and Select Currents

V_1	V_2	V_a	V_b	V_c	V_d	I_{s1}

Table 5.7: PSpice Simulated Branch Currents

I_{s1}	I_1	I_2	I_3	I_4	I_5	I_6

Approved by: _____ **Date:** _____