EXPERIMENT 1:

Kirchhoff's Voltage and Current Laws

Objective:

Verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) using mesh and nodal analysis of the given circuit.

Equipment:

➢ NI – ELVIS Board
➢ Assorted Resistors.(1 KΩ (2) ,1.2 KΩ (2), 2.4 KΩ)

Theory:

1. Kirchhoff's Voltage Law states that the algebraic sum of all the voltages around any closed path (loop or mesh) is zero.

Applying Kirchhoff's voltage law to the first and the second loops in the circuit shown in Figure 1 yields:

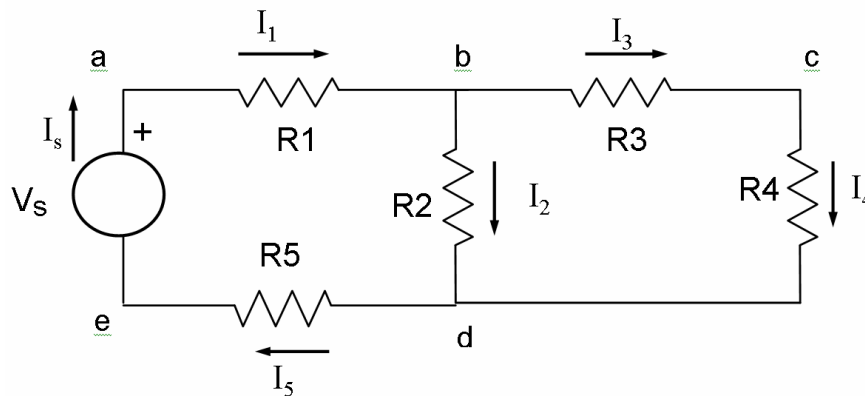|		
Loop 1:	$-Vs + V_1 + V_2 + V_5 = 0$	(1a)
Loop 2:	$-V_2 + V_3 + V_4 = 0$	(1b)

Figure 1

2. Kirchhoff's Current Law states that the algebraic sum of all the currents at any node is zero.

Applying Kirchhoff's current law to the first four nodes in the circuit shown in Figure1 yields the following equations;

Node a:	$-I_s + I_1 = 0$	(2a)
Node b:	$-I_1 + I_2 + I_3 = 0$	(2b)
Node c:	$-I_3 + I_4 = 0$	(2c)
Node d:	$-I_2 - I_4 + I_5 = 0$	(2d)

Procedure:

1. Construct the circuit shown in Figure 1 using the values below:

    $R_1 = 1$ KΩ

    $R_2 = 2.4$ KΩ

    $R_3 = 1.2$ KΩ

    $R_4 = 1$ KΩ

    $R_5 = 1.2$ KΩ

2. Set the Variable Power Supply (Vs) to 5 Volts.
3. Accurately measure all voltages and currents in the circuit using the Digital Multi-Meter (DMM).
4. Record the measurements in a tabular form containing the measured voltage and current values as shown below.

Branch current/voltage	V [volts]	I [mA]	R [KΩ]
V1, I1			
V2, I2			
V3, I3			
V4, I4			
V5, I5			
Vs, Is			

5. Verify KVL for the loops in the circuit using equations 1a and 1b.
6. Verify KCL for the nodes in the circuit using equations 2a, 2b, 2c and 2d.

Questions for Lab Report:

1. Theoretically calculate the voltages and currents for each element in the circuit and compare them to the measured values.
2. Compute the percentage error in the two measurements and provide a brief explanation for the error.