

EE283 Lab 3

KVL and KCL Measurements

And

Node Analysis

Objective: The object of this exercise is to

- Verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL).
- Calculate and simulate the voltages and currents in the circuit used for KVL and KCL.

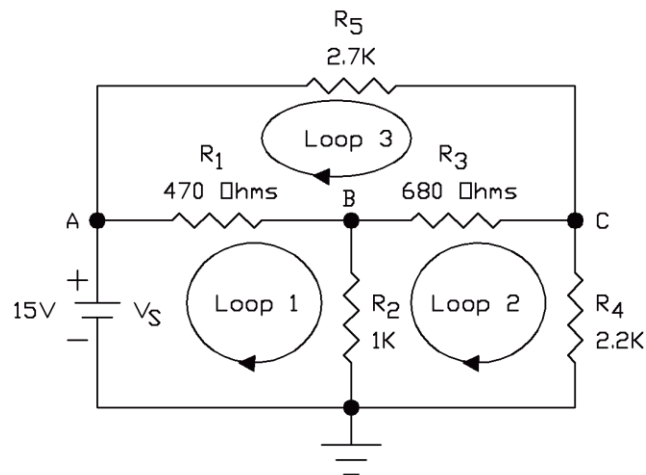
Equipment Operation:

- Digital Multimeter (DMM)
- Resistor Color Codes (see attachment A)
- Power Supply (see attachment B)
- Breadboard (see attachment C)

Procedure:

- Use the DMM to measure the voltage across each component and the current through each component to verify KVL and KCL.
1. Using the resistors supplied, measure the resistance values using the DMM and record the values and tolerances in the table below and in your report. Then construct the circuit below on your breadboard.

Reference Designation	Nominal Resistance value – Ohms	Actual Resistance Value – Ohms	Resistor Tolerance %
R ₁	470		
R ₂	1K		
R ₃	680		
R ₄	2.2K		
R ₅	2.7K		



2. Using the DMM set to measure V_{DC} measure the voltage at nodes A, B and C. Also measure the voltage across R_1 , R_3 and R_5 . Record these voltages in the table below being very careful to observe the correct polarity for the resistor voltages (i.e. for resistor R_1 measure V_{A-B} with the positive DMM lead connected at node A and the COM DMM lead connected at node B)

Record these values in your report.

V_A	V_B	V_C	V_{A-B}	V_{B-C}	V_{A-C}
V_{DC}	V_{DC}	V_{DC}	V_{DC}	V_{DC}	V_{DC}

Using the voltages measured in the table above add all of the voltages in each of the three loops shown. Show your work here and in your report.

Σ Loop 1 voltages: _____ V_{DC}

Σ Loop 2 voltages: _____ V_{DC}

Σ Loop 3 voltages: _____ V_{DC}

Is the KVL satisfied for these loops?

3. Using the DMM set to measure A_{DC} measure the current through each of the resistors and the power supply. Record these currents in the table below being very careful to observe the correct polarity for the currents (i.e. for resistor R_1 if voltage V_{A-B} is positive lift the resistor lead at node A and insert the DMM with the positive lead connected to node A and the COM DMM lead connected to R_1).

$I_{Power\ Supply}$	I_{R1}	I_{R2}	I_{R3}	I_{R4}	I_{R5}
A_{DC}	A_{DC}	A_{DC}	A_{DC}	A_{DC}	A_{DC}

Using the currents measured in the table above add all of the currents at each of the nodes shown. Show your work here and in your report.

Σ Node A currents: _____ A_{DC}

Σ Node B currents: _____ A_{DC}

Σ Node C currents: _____ A_{DC}

Is the KCL satisfied for these nodes?

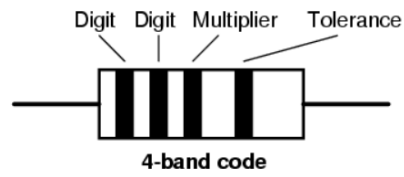
- Calculate the node voltages and component currents using either MatLab, Excel or by hand calculation. Use the actual resistance values for your calculations. Record these values in the table below and in your report. Simulate the circuit using LTspice or PSpice and record the node voltages in the table below and in your report. Use the actual resistance values for your simulation. Show your simulation circuit in the report (it should have a white background) and the reference designations should agree with those shown in the figure in this exercise.

	V_A	V_B	V_C	I_{R1}	I_{R2}	I_{R3}	I_{R4}	I_{R5}	$I_{PWR SUP}$
	V_{DC}	V_{DC}	V_{DC}	A_{DC}	A_{DC}	A_{DC}	A_{DC}	A_{DC}	A_{DC}
Calculated Values									
Simulated Values									

- **Conclusion:** In your report compare the measured, calculated and simulated values of all of the voltages and currents. Were KVL and KCL satisfied? If not why not?

Remember that your report must be legible. If I can't read it you won't get credit for it!

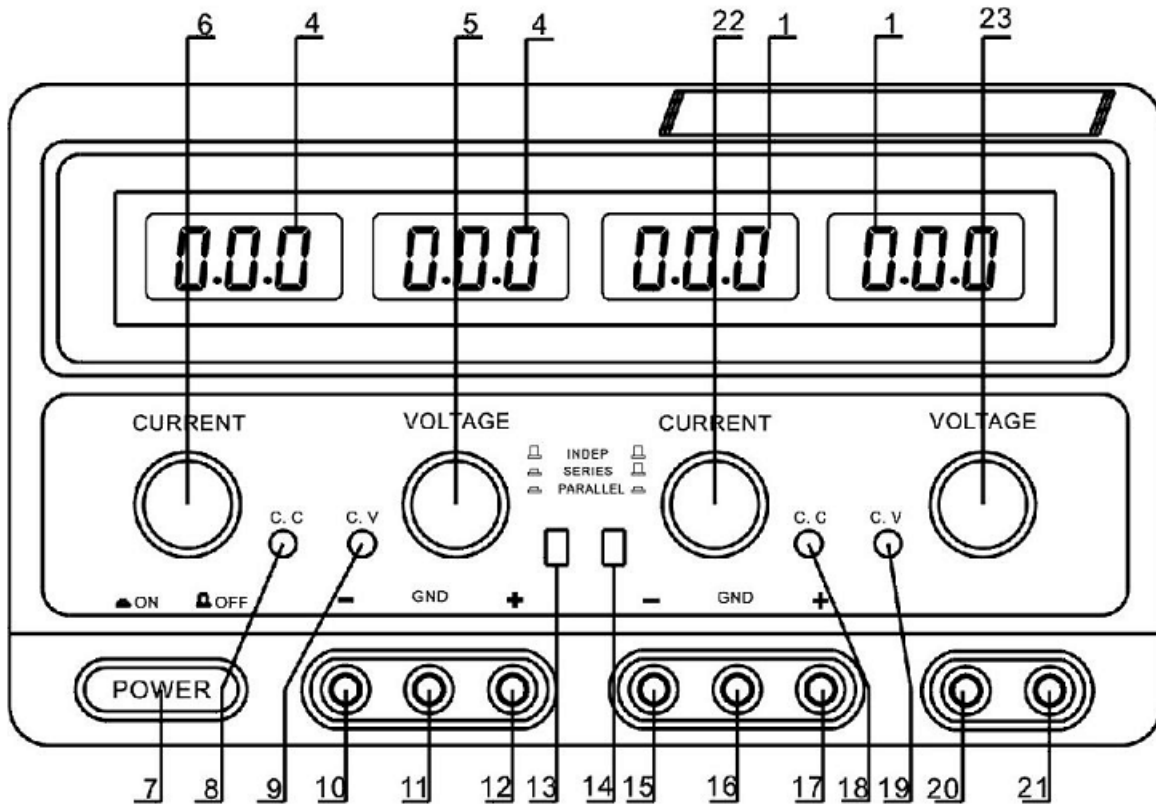
Appendix A



Color	Digit	Multiplier	Tolerance (%)
Black	0	10^0 (1)	
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
(none)			20

Appendix B

TekPower TP3005D-3 Power Supply



To turn this power supply on push in the power switch 7. This unit has three independent and isolated power supplies.

The first supply has an adjustable voltage range of 0 to 30 volts and can supply up to 5 amperes of current. The controls and terminals for this supply are located on the left side of the unit. Knob 5 controls the voltage, knob 6 sets the maximum current limit and the output voltage is obtained from terminals 12(+) and 10(-). Terminal 11 is connected to the chassis (we won't use this terminal). The digital readout directly above the current limit knob displays the power supply current and the digital readout directly above the voltage adjustment knob displays the power supply output voltage. If the power supply is in voltage control mode the indicator light 9 will be illuminated. If the power supply is in current limiting mode the indicator light 8 will be illuminated. We will always operate the power supply in voltage control mode.

The second power supply is identical to the first power supply except that all of the controls and terminals are located on the right hand side of the unit.

The third power supply has a fixed voltage of 5 V_{DC} which is obtained from terminals 21(+) and 20(-). We will use this voltage for our digital lab exercises.

Breadboard Connections

These holes are all connected together but they are not connected to anything else.

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Integrated circuit 14 pin dip package is inserted here so the package pins are inserted into the column E and F holes. Connection to the package pins is then made by connecting wires to the A,B,C and D holes or the G, H, I and J holes

