Electrical Circuits LAB #2 - Electrical Circuit Implementation & Measurement

Objectives

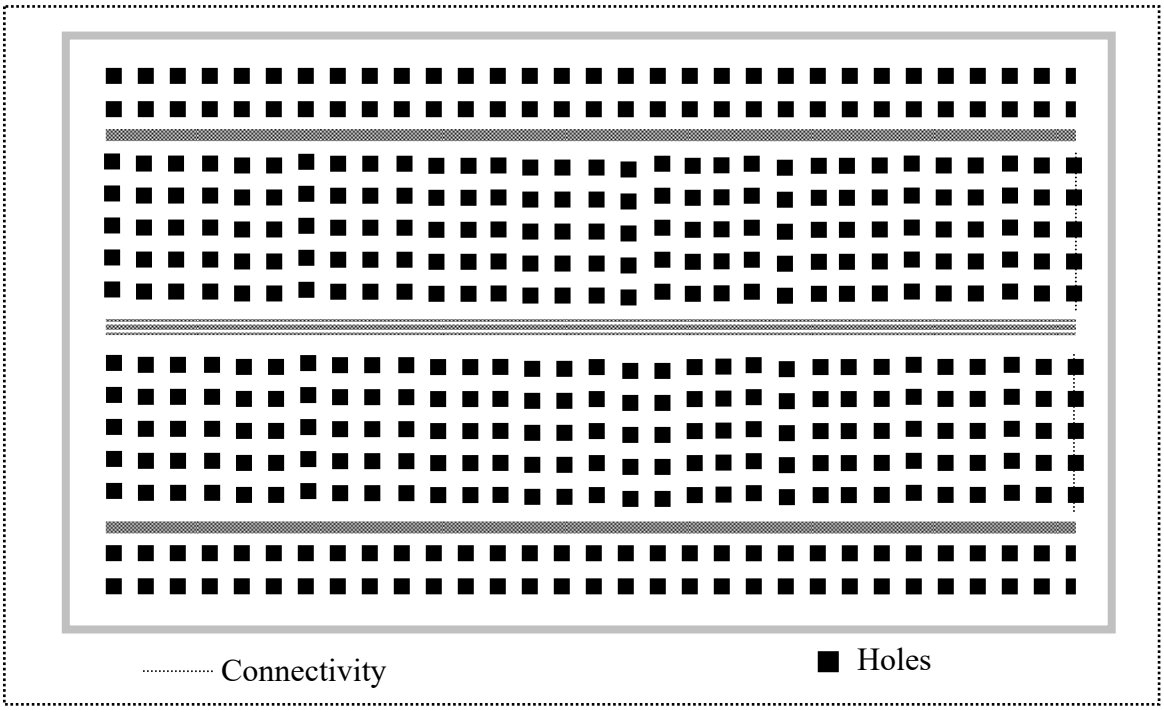
Understand and apply of electrical components, Ohms Law, circuit implementation and measurements.

Material

- Textbook: Electrical Circuits by Nilsson
- Instruments: Power Supply and Multimeter
- Supplies:
  - Electrical Tool Box
  - Proto Board
  - Probes & Connecting Cables
  - 10 KΩ thermistor
  - 10 KΩ potentiometer
  - Two red LEDs
  - DIP 8-switch pack
  - Available resistors

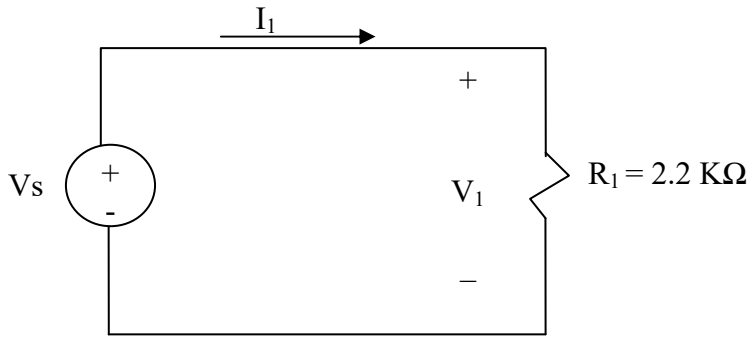
Experiment 1

Circuit proto boards are used for building experimental circuits for evaluation purposes. The key benefit of proto board is the easy of assembly and disassembly. Select a proto board and describe connectivity between the proto board holes. You may use the Multimeter's ohmmeter capability to determine connectivity.



Experiment 2

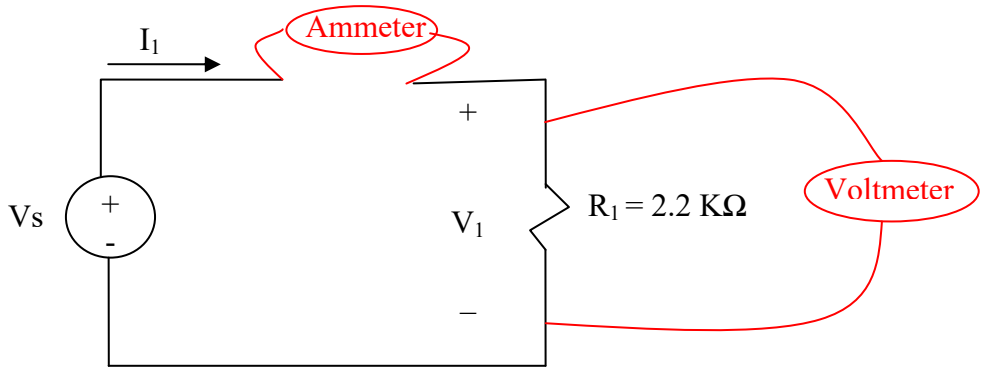
a) Implement the following circuit:



b) Write equations that describe the relationships between I_1. R_1, V_1, and Vs in the above circuit.

c) Plot I_1 v.s. V_1 as the value of Vs changes from 1 to 5 volts in 0.5 volt steps using the relationship derived in part b.

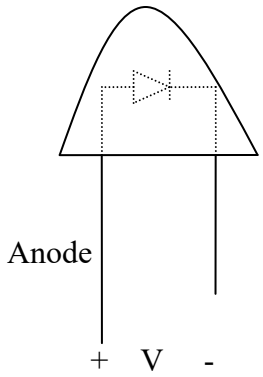
d) Using Voltmeter and Ammeter functionality of the Multimeter, measure values of I_1 and V_1 as supply voltage, Vs, is changed from 1 to 5 volts in 0.5 volt steps. Plot the results on the same sheet as the plot from part c.



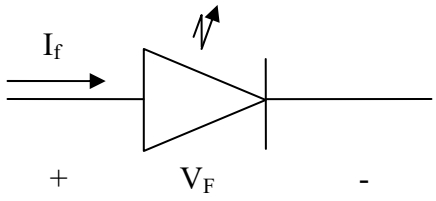
e) Based on the components used, what is the expected the average slope of plots in part c & part d? Explain any differences observed between expected slope and value calculated/measured in parts c and part d.

Experiment 3

Light Emitting Diode (LED) is used as an indicator in many applications from power on/off light to traffic signal lights, displays, car lights. LED brightness, current and power specifications vary depending on design and application. LEDs used in this lab are specified below (Lumex SSL-LX5093LXX):



Packaging Configuration

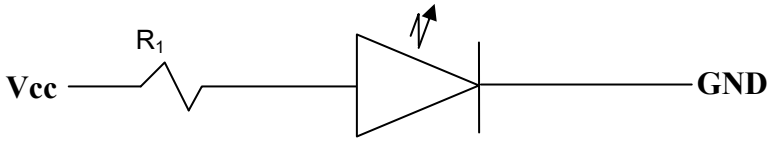


Functional Diagram

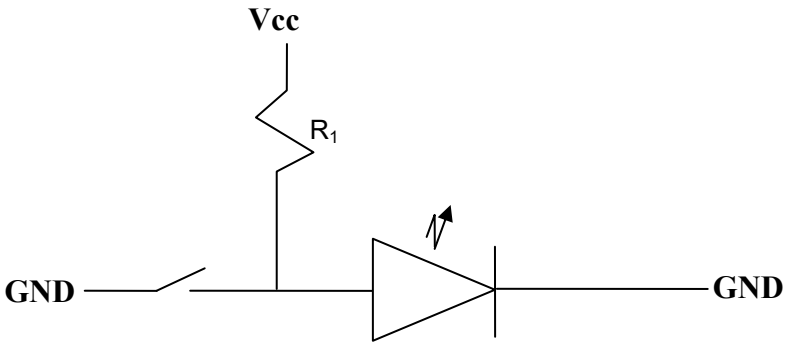
Rating: I_f < 30 mA at 2.5 Volts
Typical: +5 V at I_f = 5 ma
V_F = 1.7 V *"Assume for this Lab"*

Set up the following two configurations and record your observations. Explain any observed differences in terms of current across R_1 when R_1 is equal to 1.0 KΩ, 3.3 KΩ & 10 KΩ.

Configuration #1:



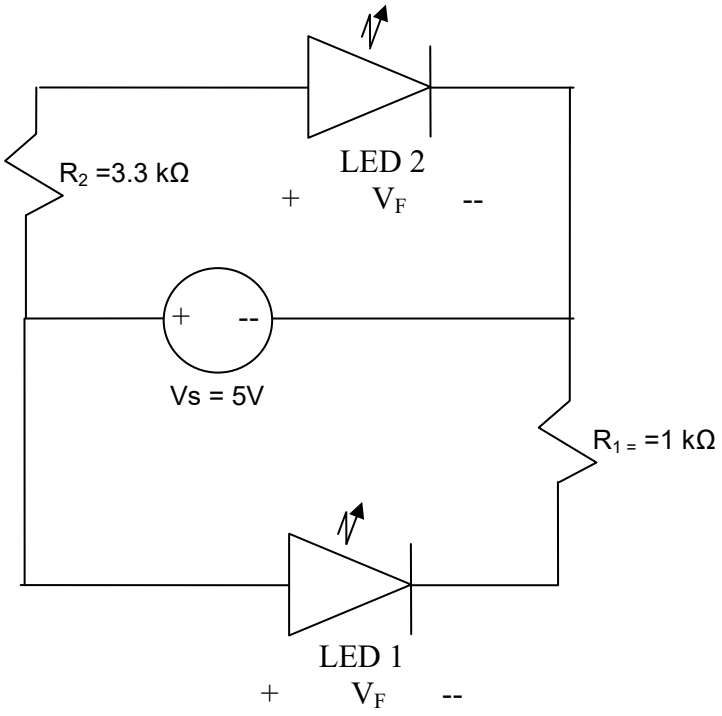
Configuration #2:



Design a circuit using +5 V power supply to drive the LED at 75% of its rated power. Review your design with the instructor prior to testing.

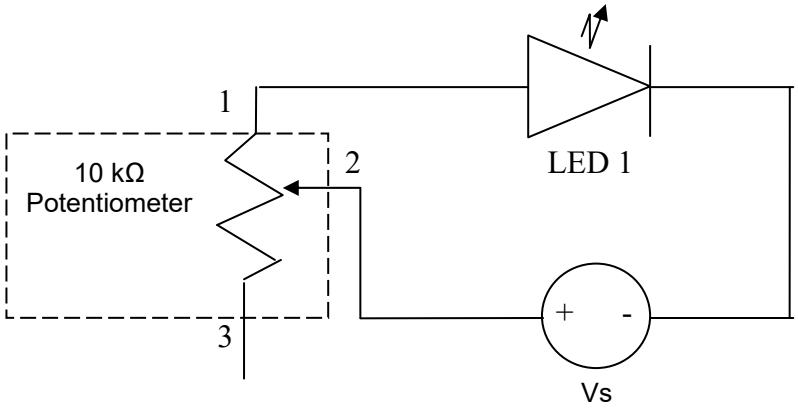
Experiment 4

a) Implement the following circuit and calculate the forward current through LED 1 and 2. Assume the forward voltage through a LED is V_F = 1.7 Volts with variable resistance and reverse resistance through a LED is ∞ Ω (Open).



b) Describe the correlation between LED brightness and current flowing through the LEDs. Do you believe the relationship is linear or non-linear?

c) Use a 10 KΩ potentiometer as shown in the following circuit to test your statement in part b. Show the data and method used to prove or disprove your statement.



Experiment 5

Determine the variation in Ohms for the 10 KΩ thermistor from room temperature to human body temperature. Also, determine the approximate ohms/degree Celsius variability of the thermistor in this temperature range.

Report Requirements

Reports must be prepared individually even if the experiments are performed as a team. All reports must be computer printed (Formulas and Diagrams may be hand drawn) and at minimum include:

For each Experiment

a) Clear problem statement; specify items given and to be found.
b) Identify the theory or process used.
c) Documents resulting circuits, calculation, tables, timing diagram, schematic and other relevant results.

For the report as a whole

a) Cover sheet with your name, class & section, lab number & title, completion date and team members' full names.
b) Lessons Learned from the experiments.
c) A new experiment and expected results which provide additional opportunity to practice the concepts in this lab.