

UM-SJTU JI 2024 FA VE215 Lab#1

We will test some properties of DC circuits in this lab.

- Please hand in your post-lab assignment before the due date. Please do your post-lab assignment following the requirements in each problem. Both hand-written and printed are accepted.

- You are encouraged to print this lab manual and then finish the post-lab questions on it. For pictures or diagrams, you may print it in a paper, cut it down and paste on this worksheet.

Instruments

DC power supply (Agilent E3631A or MOTECH LPS 305)

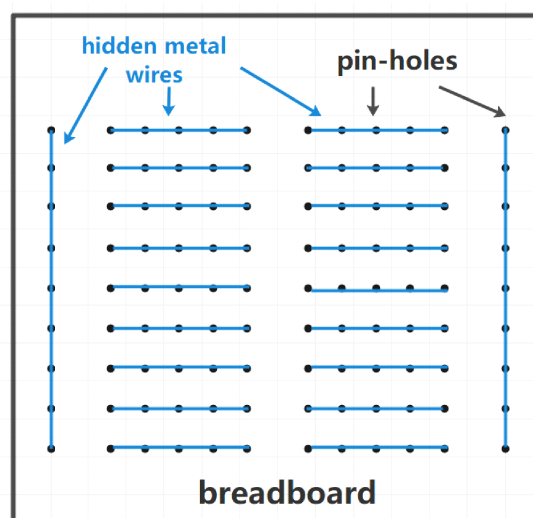
Multi-meter

Resistors of 50Ω and 100Ω

Light-Emitting Diode (LED)

Breadboard and Wires

Instruments Introduction



For **breadboards**, the picture above shows its inner structure. The nodes

represent the pin-hole and the blue lines represent the metal wires hidden inside the board.

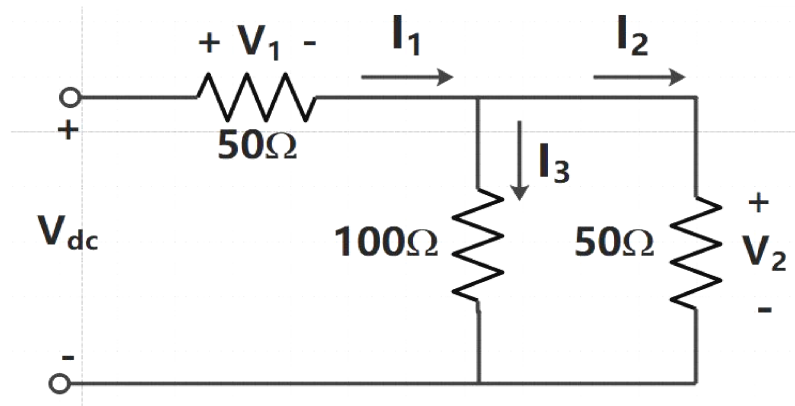
For **multi-meters**, please rotate the knob from “**off**” to the required function (including DC current, DC voltage, resistance, AC current, AC voltage) with the proper measuring range according to your measurement.

- For DC voltage measurement, please rotate the knob of multi-meter from “**off**” to “ \bar{V} (or \overline{mV})” and connect the two ports in parallel with the element to be measured.
- For DC current measurement, please rotate the knob of multi-meter from “**off**” to “ \bar{A} (or \overline{mA})” and connect it in series with the element to be measured, in other words, please connect it directly inside the circuit.
- For resistance measurement, please rotate the knob of multi-meter from “**off**” to “ Ω ” and connect the element to be measured in parallel with the multi-meter **independently**. **Caution: Please do not measure the resistance of elements when it's connected in the circuit otherwise the result will be disturbed.**

Mention that for some categories of multi-meters, you need to press the “scale” button if changing the measurement scale. Please try it and contact the TAs for help for any problems.

Problem #1 Basic Circuit Theory

Please connect the following circuit on your breadboard.



Please set the DC power supply V_{DC} to 3V and then open it.

Then, please measure the values of I_1 , I_2 , I_3 , V_1 and V_2 using multi-meter and complete the following table:

Notations	I_1	I_2	I_3	V_1	V_2
Values					

Please do not break your circuit since we will use the same circuit in the next problem

Post-Lab Questions for (P1)

(1) What's the relationship among I_1 , I_2 and I_3 according to your measurement? Which circuit law could be verified based on that result?

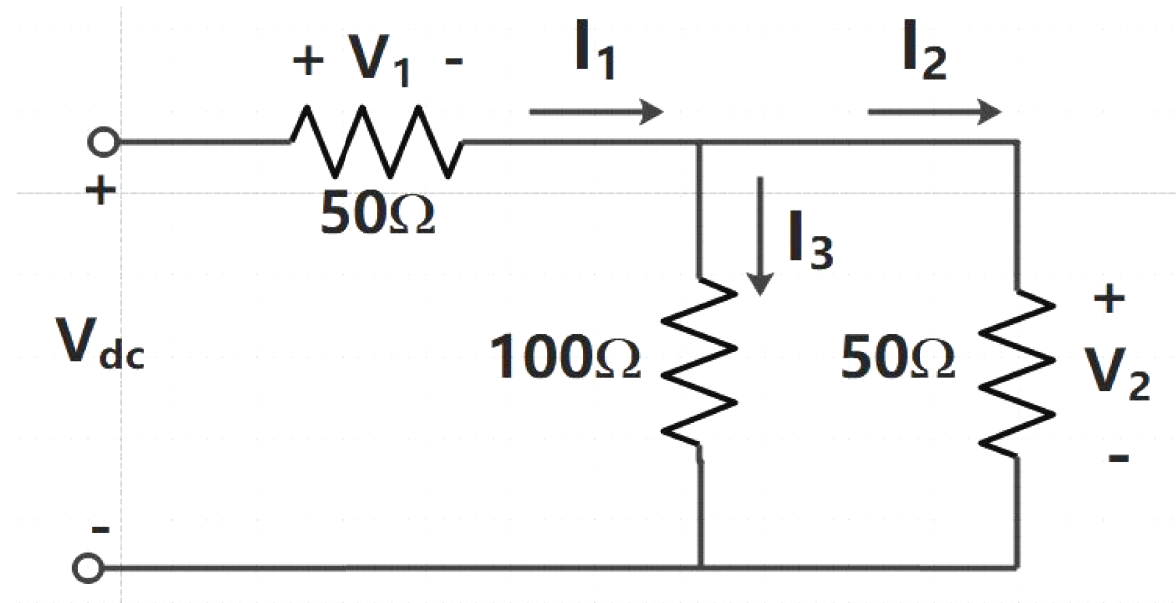
(2) What's the relationship among V_{DC} , V_1 and V_2 according to your measurement? Which circuit law could be verified based on that result?

(3) What's the value of I_2/I_3 according to your measurement? How can the result verify the current division law of the parallel connected resistors?

(4) What's the value of V_1/V_2 according to your measurement? How can the result verify the voltage division law of the series connected resistors?

Problem #2 Ohm's Law

Please use the same circuit as your problem 1.



Please set the DC power supply V_{DC} to 1V, 2V, 3V, 4V, 5V and measure the values of I_2 & V_2 corresponding to each V_{DC} .

Please complete the following table during your experiment.

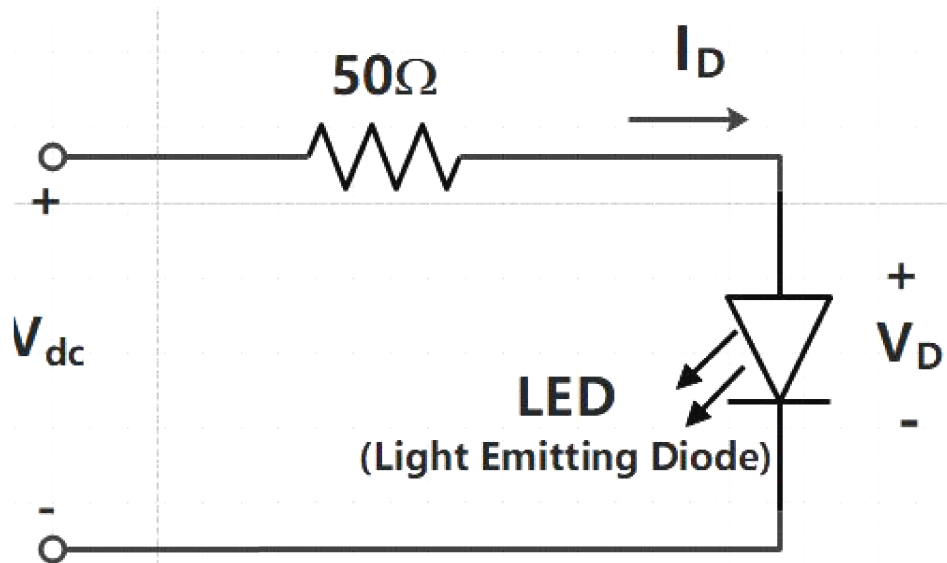
Source Voltage V_{DC}	I_2	V_2
1V		
2V		
3V		
4V		
5V		

Post-Lab Questions for (P2)

(1) Please plot the curve of V_2 and I_2 . Explain: How can this curve verify the Ohm's law?

Problem #3 Non Linear Circuit

Please connect the following circuit on your breadboard.



Please set the DC power supply V_{DC} to 1.0V, 1.2V, 1.4V,

1.6V... 2.8V and 3.0V and measure the values of **I_D** & **V_D** corresponding to each **V_{DC}** .

Please complete the table next page during your experiment.

Source Voltage V_{DC}	I_D	V_D
1.0V		
1.2V		
1.4V		
1.6V		
1.8V		
2.0V		
2.2V		
2.4V		
2.6V		
2.8V		
3.0V		

Post-Lab Questions for (P3)

(1) Please plot the curve of **V_D** and **I_D** . Is this LED a linear circuit element based on the curve you obtained? Why?

(2) What's the purpose of connecting the 50Ω resistor in series with the LED? What will happen if we do not connect it?

References

- [1] *Circuits Make Sense*, Alexander Ganago, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor.