Laboratory Manual

EE-153L – Introduction to Electrical Engineering

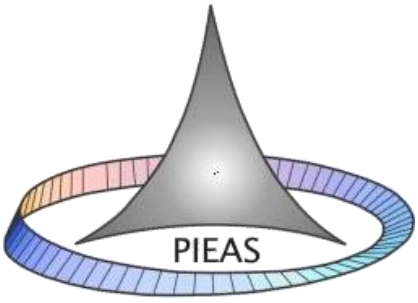
Fall 2025

Instructor

Engr. Noman Khan

Lab Engineers

Engr. Bilal Haider
Engr. Yasir Kamal



Department of Electrical Engineering
Pakistan Institute of Engineering & Applied Sciences
Islamabad, Pakistan

Experiment 4

Verification of Ohm's Law

4.1 Objective

This exercise examines Ohm's law, one of the fundamental laws governing electrical circuits. It states that voltage is equal to the product of current and resistance.

4.2 Theory Overview

Ohm's law is commonly written as V = I R. That is, for a given current, an increase in resistance will result in a greater voltage. Alternately, for a given voltage, an increase in resistance will produce a decrease in current. As this is a first order linear equation, plotting current versus voltage for a fixed resistance will yield a straight line. The slope of this line is the conductance, and conductance is the reciprocal of resistance. Therefore, for a high resistance, the plot line will appear closer to the horizontal while a lower resistance will produce a more vertical plot line.

4.2.1 Pre-Lab Task

Before performing the experiment in the laboratory, complete the following tasks in **LTspice** to demonstrate your understanding of the theoretical concepts. These preparatory tasks will help you predict circuit behavior and verify your results during the lab session.

4.3 Equipment

- Adjustable DC Power Supply model:_____
- Digital Multimeter model :_____
- 1 kΩ resistor _____
- 6.8 kΩ resistor _____
- 33 kΩ resistor _____

4.4 Schematic

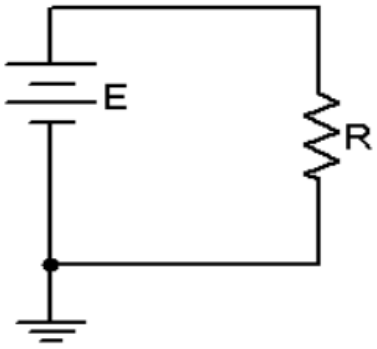


Figure 4.1: Electrical Circuit with resistance

4.5 Procedure

1. Build the circuit of Figure 4.1 using the 1 kΩ resistor. Set the DMM to measure DC current and insert it in-line between the source and resistor. Set the source for zero volts. Measure and record the current in Table 4.1. Note that the theoretical current is 0 and any measured value other than 0 would produce an undefined percent deviation.
2. Setting E at 2 volts, determine the theoretical current based on Ohm's law and record this in Table 4.1. Measure the actual current, determine the deviation, and record these in Table 4.1. Note that Deviation = 100 * (measured – theory) / theory.
3. Repeat step 2 for the remaining source voltages in Table 4.1.
4. Remove the 1 kΩ and replace it with the 6.8 kΩ. Repeat steps 1 through 3 using Table 4.2.
5. Remove the 6.8 kΩ and replace it with the 33 kΩ. Repeat steps 1 through 3 using Table 4.3.
6. Using the measured currents from Tables 4.1, 4.2, and 4.3, create a plot of current versus voltage. Plot all three curves on the same graph. Voltage is the horizontal axis and current is the vertical axis.

4.6 Data Tables

Table 4.1 (1 kΩ)

E (volts)	I theory	I measured	Deviation
0	0		
2			
4			
6			
8			
10			
12			

Table 4.2 (6.8 kΩ)

E (volts)	I theory	I measured	Deviation
0	0		
2			
4			
6			
8			
10			
12			

Table 4.3 (33 kΩ)

E (volts)	I theory	I measured	Deviation
0	0		
2			
4			
6			
8			
10			
12			

4.7 Questions

1. Does Ohm's Law appear to hold in this exercise?

2. Is there a linear relationship between current and voltage?

3. What is the relationship between the slope of the plot line and the circuit resistance?

4.8 Conclusion

Assessment

Sr. No.	Specific Course Learning Outcomes	Knowledge Domains	Performance indicator
	Upon completion of this course, the students will be able to		
1	**USE** electronic lab instruments including the digital multi-meter, function generator, oscilloscope and electronic circuit trainer.	P1	• Correct use of needed instruments (signal generator, oscilloscope, etc.) Study and complete pre-lab tasks
2	**CONSTRUCT** and **ANALYZE** basic circuits.	P2	• Proper designing, wiring of the circuit as per requirement. • Analyzing the circuit and recording the data. • Relate experiment with theoretical concept discussed in class • Discuss discrepancies between theoretical, simulation and experimental results • Performing the necessary calculation required in the lab and investigate effect of various changes.
3	**COMMUNICATE** clearly and effectively through presentation and/or report.	A2	• Report is structured properly Figures and Graphs annotated
4	**DEMONSTRATE** teamwork and show commitment to the group in achieving the objectives of laboratory.	A2	• Take his/her part in the group.
5	**DEMONSTRATE** punctuality, dress appropriately and comply with the standard safety procedures of the lab.	A2	• Wear proper dress to perform the tasks and Follow lab timing • Follow safety instructions for handling the instruments.