



# Pre-Lab 1

## Ohm's Law

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# Contents

<b>1</b>	<b>Overview</b>	<b>3</b>
<b>2</b>	<b>Pre-Lab Tasks</b>	<b>4</b>
2.1	Theoretical Analysis . . . . .	4
2.2	LTspice Simulations . . . . .	4
2.3	Resistor Colour Code . . . . .	4
<b>3</b>	<b>Pre-Lab Exercises</b>	<b>5</b>
3.1	Exercise #1 . . . . .	5
3.2	Exercise #2 . . . . .	7
3.3	Exercise #3 . . . . .	8
3.4	Exercise #4 . . . . .	9
<b>4</b>	<b>Conclusion</b>	<b>10</b>

# Chapter 1

## Overview

The purpose of this pre-lab report is to prepare for Laboratory Work #1 in the ESD Capsule. This lab aims to familiarize students with basic electronic equipment and components commonly used in laboratory settings. The tasks involve theoretical analysis, LTspice simulations, and practical measurements using laboratory instruments.

# Chapter 2

## Pre-Lab Tasks

### 2.1 Theoretical Analysis

We analyzed each circuit theoretically and calculated the expected values based on the provided circuit configurations and component values.

### 2.2 LTspice Simulations

Using LTspice, we implemented each circuit and conducted simulations to verify the expected outcomes. The simulation results were appropriately labeled and aligned with the theoretical analysis.

### 2.3 Resistor Colour Code

We determined the color codes of resistors using the Resistor Colour Code and showcased the calculation process to identify the resistance values.

# Chapter 3

## Pre-Lab Exercises

### 3.1 Exercise #1

Color	1st Band	2nd Band	3rd Band	Multiplier ( $\Omega$ )	Tolerance (%)
Black	0	0	0	1	-
Brown	1	1	1	10	$\pm 1$
Red	2	2	2	100	$\pm 2$
Orange	3	3	3	1,000	-
Yellow	4	4	4	10,000	-
Green	5	5	5	100,000	$\pm 0.5$
Blue	6	6	6	1,000,000	$\pm 0.25$
Violet	7	7	7	10,000,000	$\pm 0.1$
Gray	8	8	8	100,000,000	$\pm 0.05$
White	9	9	9	1,000,000,000	-
Gold	-	-	-	0.1	$\pm 5$
Silver	-	-	-	0.01	$\pm 10$

Table 3.1: Resistor Color Code Table [1]

In order to calculate the resistance value of a resistor using the color code, we can use the following formula:

$$\text{Resistance} = (1^{\text{st}} \text{ Band} \times 10 + 2^{\text{nd}} \text{ Band}) \times \text{Multiplier}$$

For example, let's calculate the resistance value of a resistor with the color code of **Red, Red, Orange**:

$$\text{Resistance} = (2 \times 10 + 2) \times 1,000 = 22k\Omega$$

For example, in order to find the color code of the resistor with the resistance value of  $4.7k\Omega$ , we can use the following formula:

$1^{st}$  Band = First significant digit = 4

$2^{nd}$  Band = Second significant digit = 7

$3^{rd}$  Band =  $10^{\text{Number of zeros in the resistance value}} = 10^3 = 1,000$

Color Code = Yellow-Violet-Red

Let's find the color code of these 3 resistors:

Resistor	Color Code
$R_1 = 470\Omega$	Yellow-Violet-Brown
$R_2 = 1k\Omega$	Brown-Black-Red
$R_3 = 4.3k\Omega$	Yellow-Orange-Red

Table 3.2: Color Codes for Given Resistors

## 3.2 Exercise #2

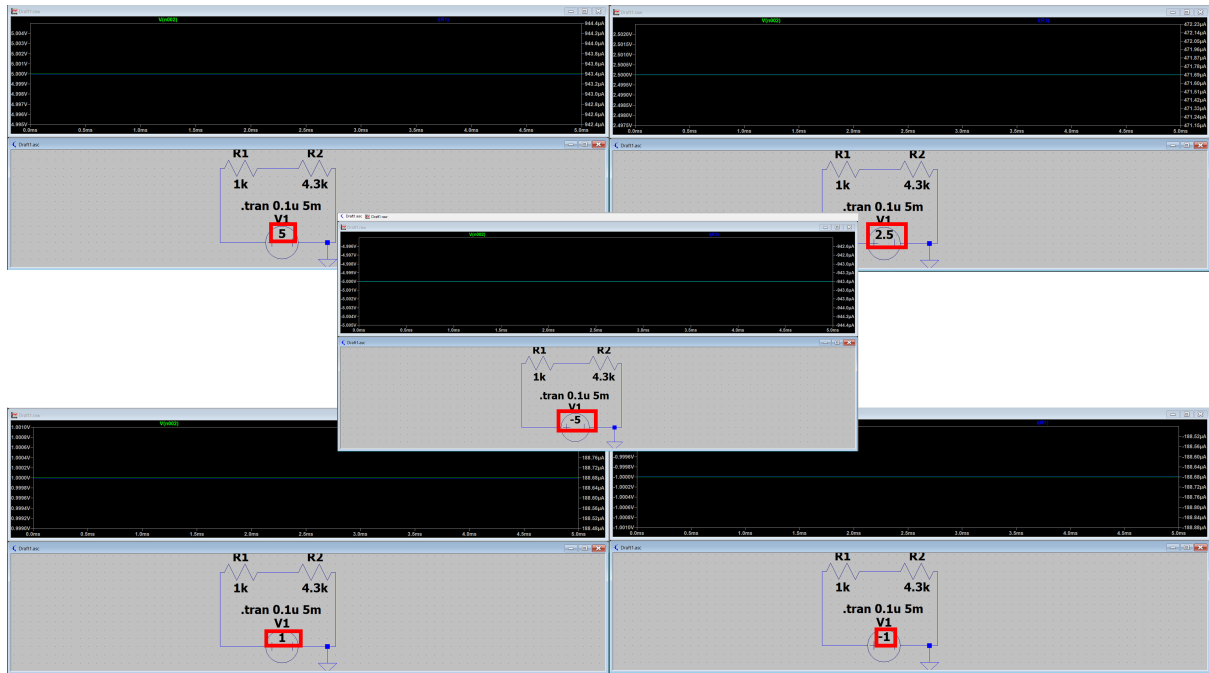
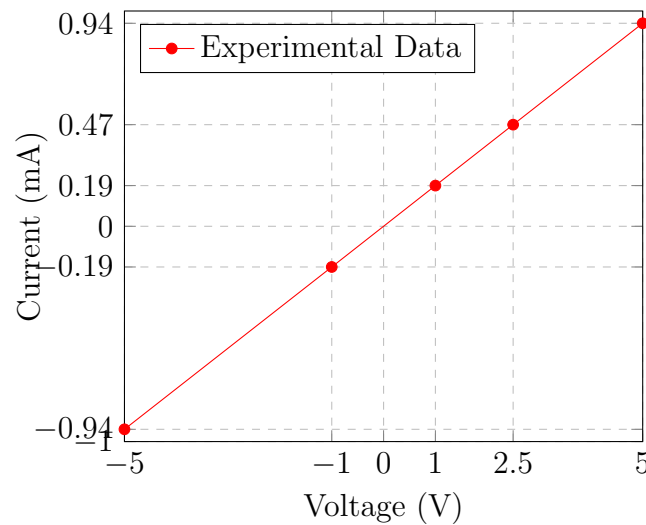


Figure 3.1: Task#2 Circuit Diagram & Calculations

We choose the following values for the voltage source:

- $V_1 = -5V$
- $V_2 = -1V$
- $V_3 = 1V$
- $V_4 = 2.5V$
- $V_5 = 5V$



### 3.3 Exercise #3

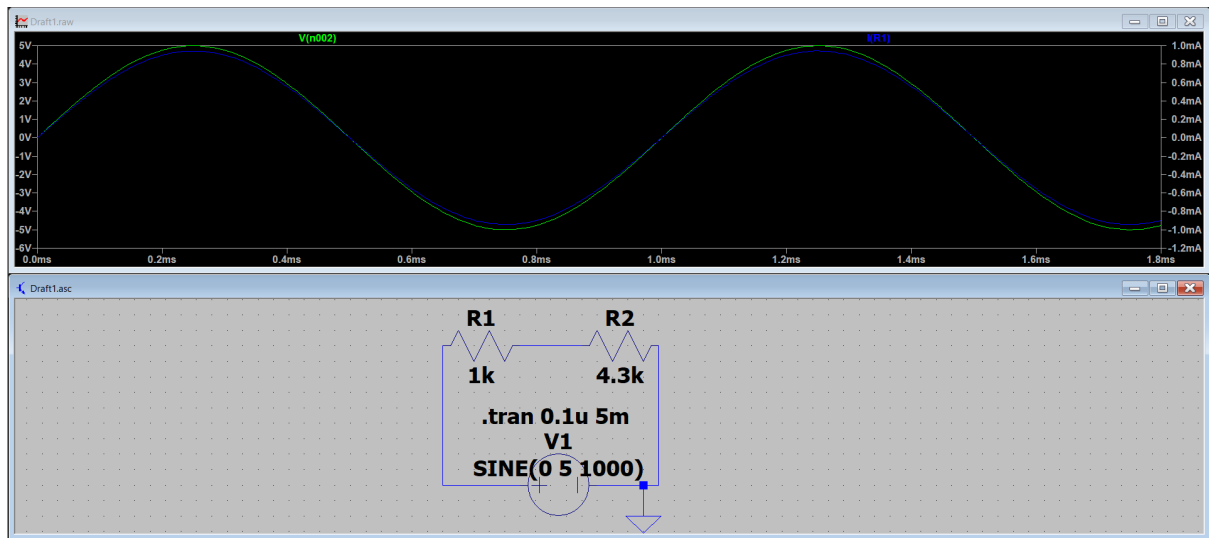


Figure 3.2: Task#3 Circuit Diagram & Calculations



### 3.4 Exercise #4

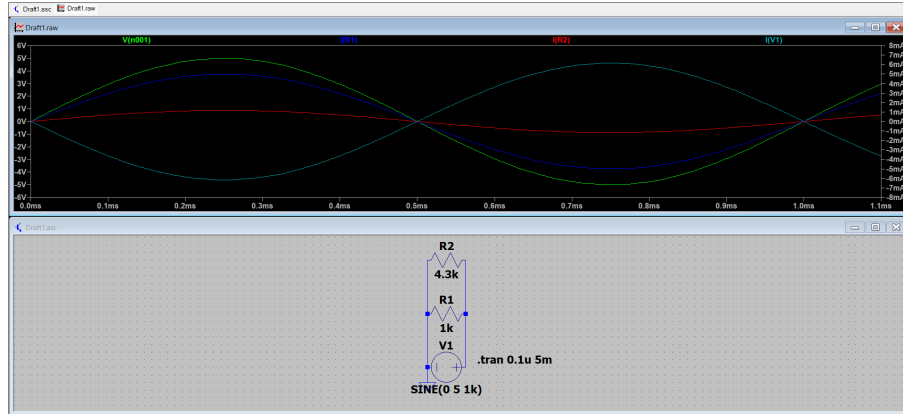


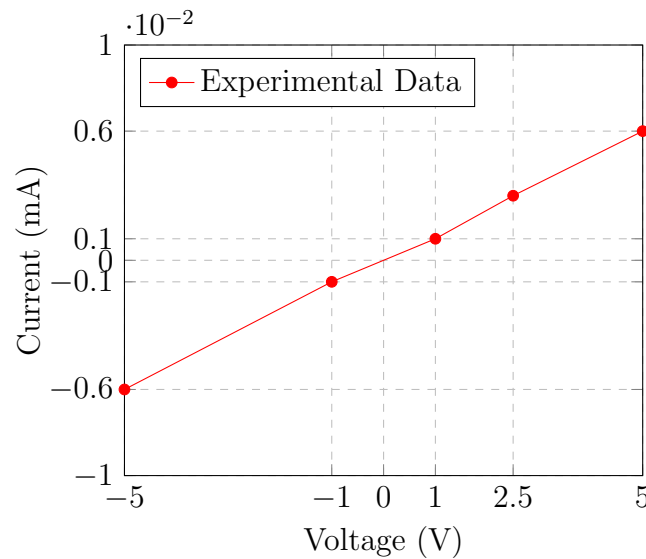
Figure 3.3: Task#4 Circuit Diagram & Calculations

First we have to calculate the equivalent resistance of the circuit. We can use the following formula to calculate the equivalent resistance of the circuit:

$$\begin{aligned}
 R_{eq} &= \frac{R_1 \times R_2}{R_1 + R_2} = \frac{1k\Omega \times 4.3k\Omega}{1k\Omega + 4.3k\Omega} \\
 &= \frac{4.3M\Omega}{5.3k\Omega} = 0.811k\Omega
 \end{aligned}$$

We choose the following values for the voltage source:

- $V_1 = -5V$
- $V_2 = -1V$
- $V_3 = 1V$
- $V_4 = 2.5V$
- $V_5 = 5V$



# Chapter 4

## Conclusion

In conclusion, this pre-lab report outlines the preparatory tasks and theoretical analysis conducted in anticipation of Laboratory Work #1. The completion of these tasks will facilitate a comprehensive understanding and successful execution of the upcoming laboratory exercises.

# Bibliography

- [1] Calculator.net. Resistor Calculator. <https://www.calculator.net/resistor-calculator.html>, Accessed March, 2024.