ECE10AL

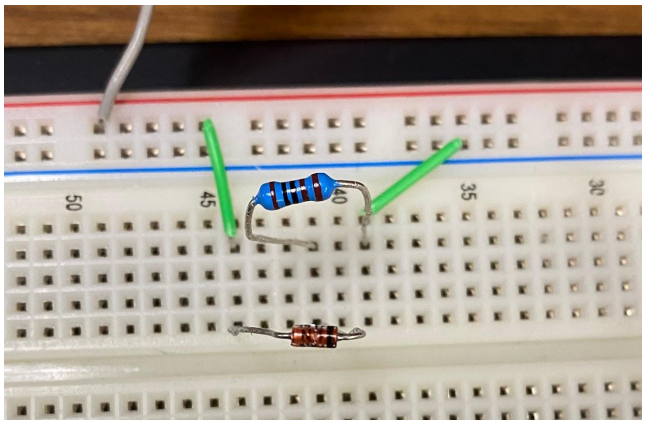
LABORATORY 6: NONLINEAR ANALYSIS OF DIODE CIRCUITS

INTRODUCTION

The purpose of this lab is to familiarize ourselves with diodes and their nonlinear properties. It is possible to observe current conduction and its ideal zero resistance, as well as current blockage and its ideal infinite resistance, by sweeping the input voltage values, measuring the voltage across the diode and resistor, as well as the diode current, and watching how it behaves before and after flipping.

Step 1:

1.1. [RP1]



1.2.

V_{in} (V)	V_D (V)	V_R (V)	I_D (mA)
-0.50	-0.518	-0.022	0
-0.40	-0.416	-0.022	0
-0.30	-0.316	-0.022	0
-0.20	-0.221	-0.023	0
-0.10	-0.124	-0.023	0
0.00	0	0	0
0.05	0.028	-0.023	0.0509
0.10	0.078	-0.022	0.1004
0.15	0.128	-0.023	0.1507
0.20	0.179	-0.022	0.2004

0.25	0.229	-0.022	0.2504
0.30	0.276	-0.021	0.3001
0.35	0.325	-0.018	0.3502
0.40	0.380	-0.012	0.4004
0.45	0.429	0.002	0.4499
0.50	0.481	0.023	0.4996
0.75	0.701	0.195	0.7496
1.00	0.814	0.415	0.9994
1.25	0.886	0.644	1.2492
1.50	0.935	0.878	1.4984
1.75	0.984	1.11	1.7484
2.00	1.03	1.35	1.9978
2.25	1.08	1.59	2.2476
2.50	1.13	1.83	2.4971
2.75	1.17	2.06	2.7470
3.00	1.23	2.29	2.9969

Table 1. DC 1-V measurements for the diode **[RP2].**

1.3.

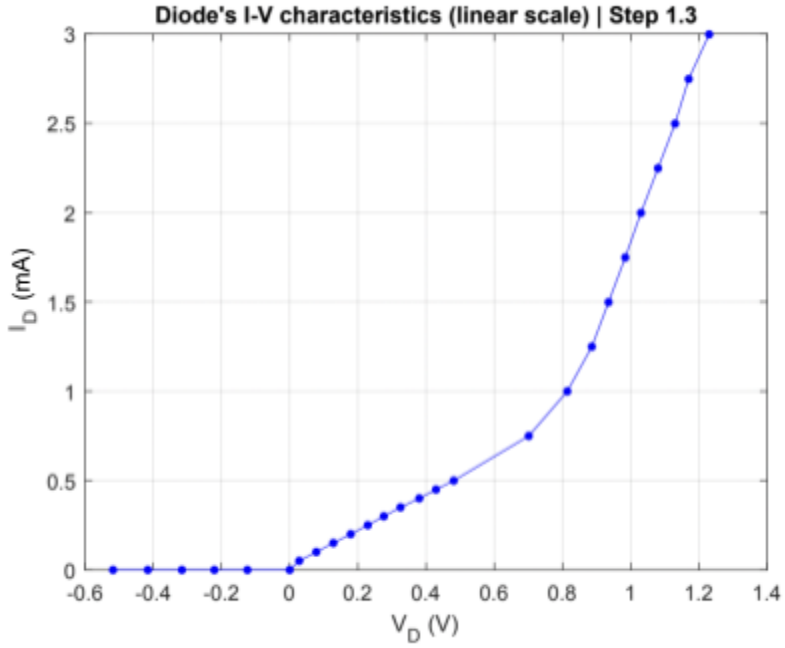


Figure 4. Linear graph **[RP3].**

1.4.

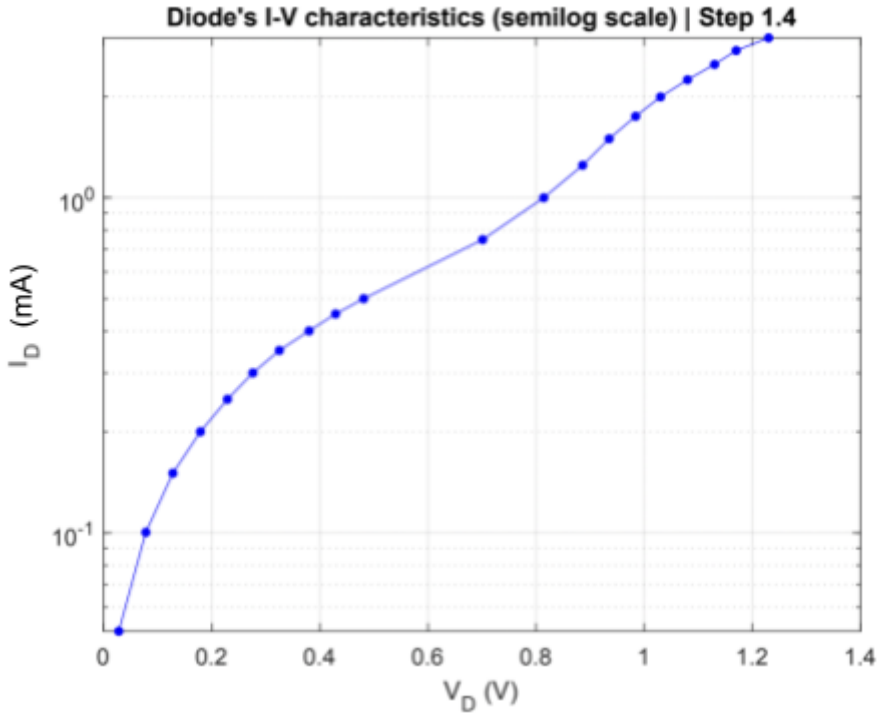


Figure 5. Semilog (log-linear) graph **[RP4]**.

1.5. I_S = 10e-2A
V_T = 0.35V
[RP5]

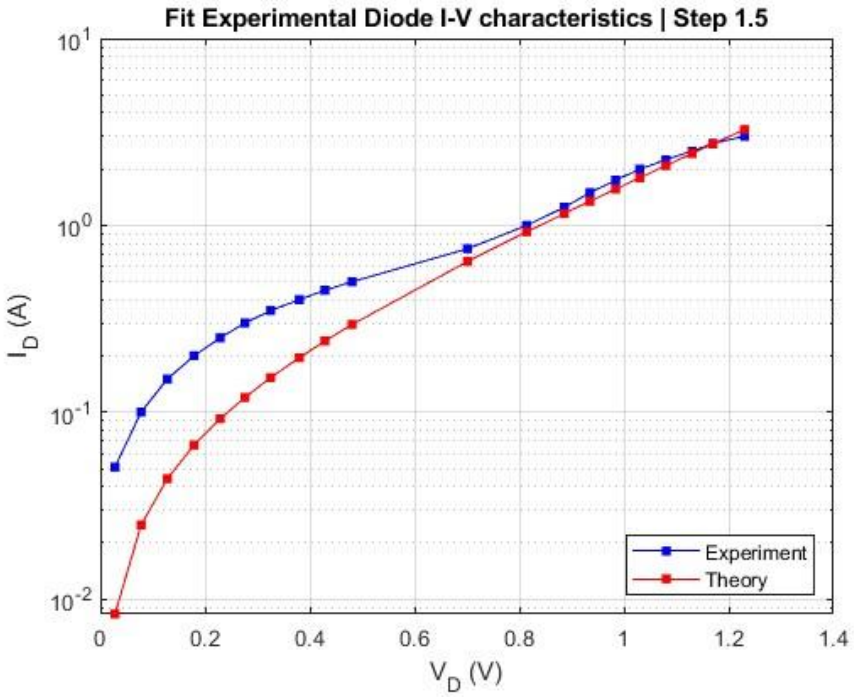


Figure 5. Semilog (log-linear) graph. **[RP6]**

Step 2:
2.1.

$V_{in,\ peak\ to\ peak}$ (V)	Calculated $V_{R,DC}$ (V)	Measured $V_{R,DC}$ (V)	Measured $I_{R,DC}$ (mA)
2	0.12732	0.0875	0.0362
3	0.28648	0.214	0.0563
4	0.44563	0.340	0.0705
5	0.60479	0.470	0.0894

Table 2. DC voltage and current across the R_1 = 1kΩ resistor **[RP7]**.

2.2.

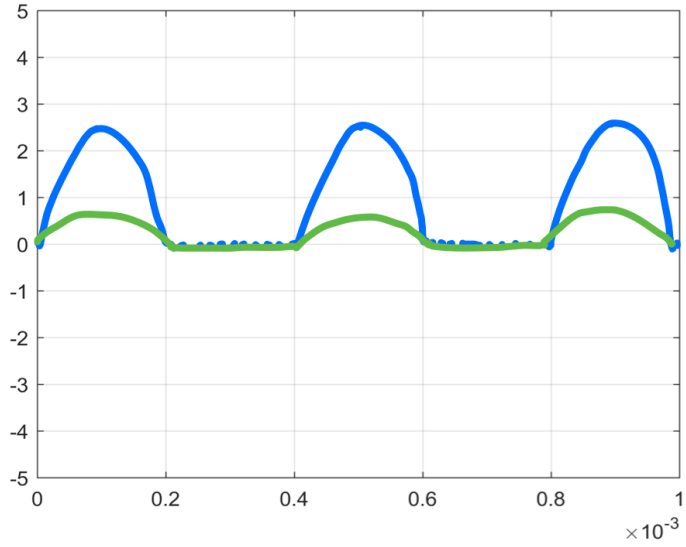


Figure 6. Linear graph.

[RP8]

2.3. The diode's orientation meant that when negative voltage was applied (voltage applied in the opposite direction), the diode prevented the current from passing through, leaving 0V recorded for the intervals between positive voltage inputs. This eliminated the sine wave's negative component.

[RP9]

Step 3:

3.1.

$V_{in,\ peak\ to\ peak}$ (V)	Calculated $V_{R,DC}$ (V)	Measured $V_{R,DC}$ (V)	Measured $I_{R,DC}$ (mA)
2	0.12732	0.044	0.0845
3	0.28648	0.123	0.1894
4	0.44563	0.210	0.2781
5	0.60479	0.304	0.3869

Table 3. DC voltage and current across the R_1 = 100 Ω resistor. **[RP10]**

3.2.

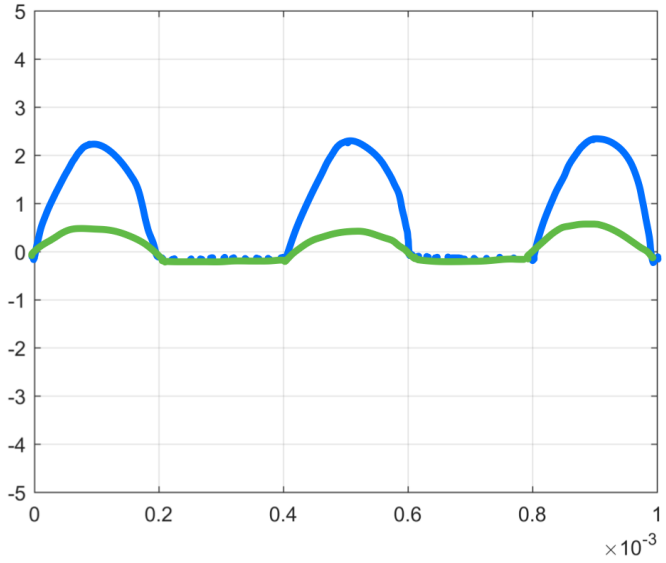


Figure 7. Linear graph.

[RP11]

Step 4:

4.1.

$V_{in,\ peak\ to\ peak}$ (V)	Calculated $V_{R,DC}$ (V)	Measured $V_{R,DC}$ (V)	Measured $I_{R,DC}$ (mA)
2	0.12732	-0.0947	-1.1059
3	0.28648	-0.193	-3.3092
4	0.44563	-0.367	-5.5832
5	0.60479	-0.531	-8.487

Table 4. DC voltage and current across the R_1 = 1 kΩ resistor with the diode flipped.

[RP12]

4.2.

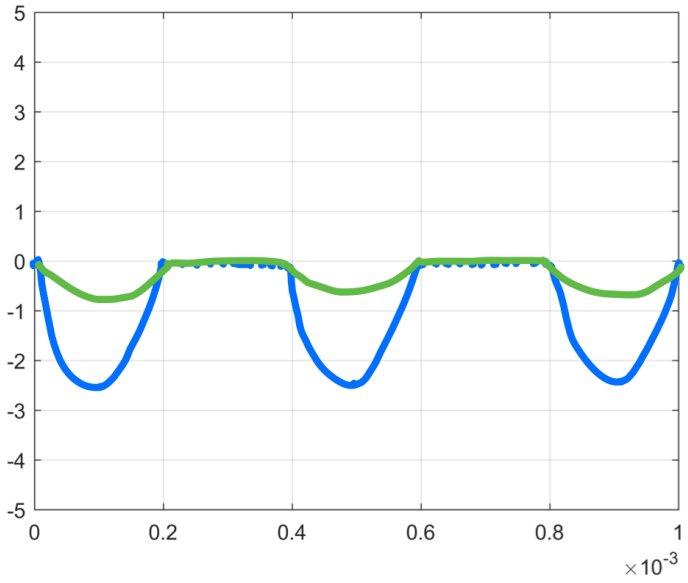


Figure 9. Linear graph.

[RP13]

4.3. The ideal V_R was zero since the cathode end of the diode was connected to the positive terminal of the voltage source, which resulted in a resistor with infinite resistance and zero volts for all input voltages. **[RP14]**

CONCLUSION

The main goal of this lab was to gain knowledge about the directional nature of diodes. The I-V relationship of a diode was demonstrated using tables and graphs in the first stage. The remaining steps demonstrated the directional nature of the diode by showing how its unique directionality effectively eliminated the circuit's negative component from the sine wave that was introduced.