

ELEC-313
Lab 3: Diode Circuits

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Partners: Charles Pittman
Stephen Wilson

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1 Objective

The objective is to observe the basic operation of a diode. In addition, the Shockley equation (Eq 2) is used to find the diode's reverse saturation current (I_S) and thermal voltage (V_T) using values measured in the lab.

2 Equipment

Diode: 1N4007

Zener diode: 1N5231

Resistors: 47Ω

Capacitor: $1\mu\text{F}$

Resistive decade box: HeathKit IN-3117

Power supply: HP E3631A

Function generator: HP 33120A

Multimeter: Fluke 8010A

Oscilloscope: Agilent 54622D

3 Schematics

(a) Circuit used for Parts A and Part B.

(b) Circuit used for Part C.

Figure 1: Circuits used in this lab.

4 Procedure

4.1 Rectifier

V_S (V)	V_{max} (V)	V_{min} (V)	V_r (V)	V_{DC} (V)	% Ripple
1	0.488	0.369	0.119	0.429	24.4
2	1.41	1.10	0.310	1.26	22.0
3	2.39	1.88	0.510	2.14	21.3
4	3.31	2.38	0.930	2.85	28.1
5	4.25	3.19	1.06	3.72	24.9

Table 1: AC input vs. DC output of rectifier circuit, where $R_L = 10\text{ k}\Omega$

R_L k Ω	V_{max} V	V_{min} V	V_r V	V_{DC}	% Ripple
1	4.13	0.440	3.69	2.29	89.3%
10	4.25	3.19	1.06	3.72	24.9%
100	4.321	4.193	0.128	4.257	2.962%

Table 2: Effect of R_L on DC output

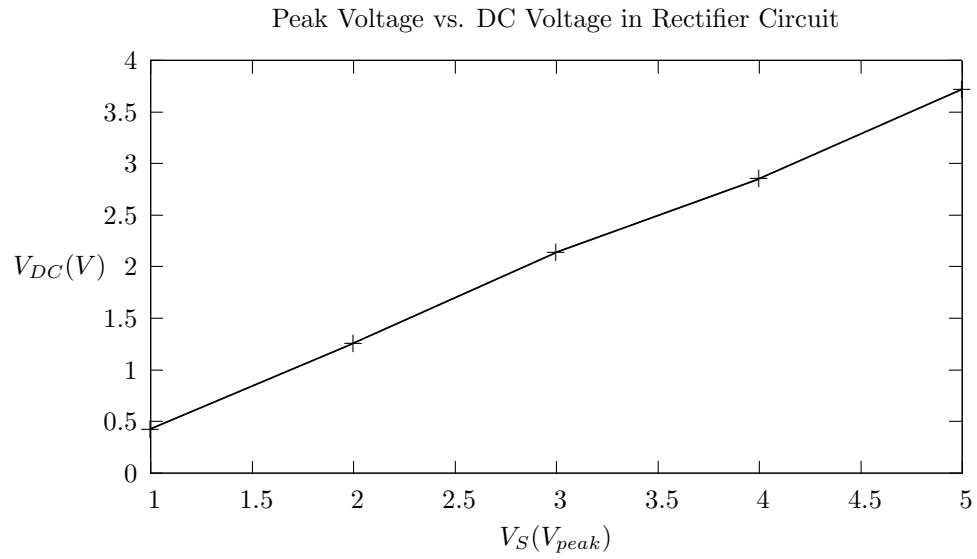


Figure 2: AC input vs. DC output of circuit, where $R_L = 10\text{ k}\Omega$

4.2 Voltage Regulator

5 Results

6 Conclusion

7 Equations

$$\%_{diff} = \frac{|nominal - measured|}{nominal} 100\% \quad (1)$$

$$I_D = I_S \left(e^{\frac{V_D}{V_T}} - 1 \right) \quad (2)$$

$$m = \frac{\ln(I_2) - \ln(I_1)}{V_2 - V_1} = \frac{1}{V_T} \quad (3)$$