ELEC-313
Lab 3: Diode Circuits

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Date Performed:	September 25, 2013
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1 Objective

The objective is to observe the basic operation of a diode. In addition, the Schockley 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: $47\,\Omega$
Capacitor: $1\,\mu$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

4.2 Voltage Regulator

5 Results

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 $R_L = 10\,\mathrm{k}\Omega$.

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

Table 2: Effect of R_L on DC output in rectifier circuit.

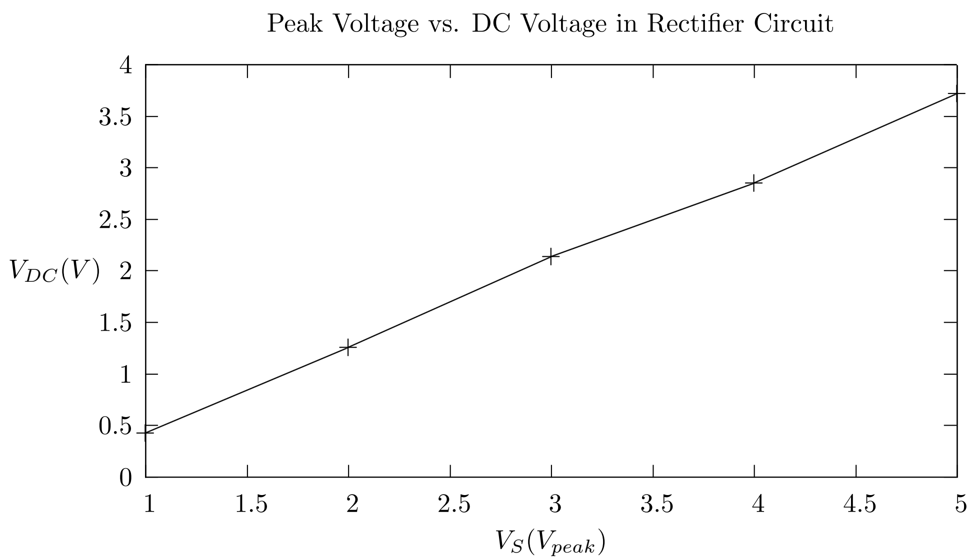

Figure 2: AC input vs. DC output of rectifier circuit, where $R_L = 10\,\mathrm{k}\Omega$

R_L (Ω)	V_{OC} (V)	V_S Drop (V)
100	6.12	7.5
330	7.88	5.8
1k	8.90	5.3

Table 3: Calculated values for voltage regulator circuit

R_L (Ω)	V_L (V)	I_L (mA	V_{OC} (V)	V_S Drop (V)	V_L Regulation
100	5.163	50.9	6.10	7.5	4.20%
330	5.318	15.62	7.87	5.9	1.17%
1k	5.11	5.27	8.60	5.3	5.28%
∞	5.38	—	—	—	—

Table 4: Measured values for voltage regulator circuit

R_L (Ω)	V_{OC} (% diff)	V_S Drop (% diff)
100	0.359%	0.0%
330	0.102%	1.7%
1k	3.327%	0.0%

Table 5: Comparison of values for voltage regulator circuit

6 Conclusion

7 Equations

$$\%_{diff} = \frac{|nominal - measured|}{nominal} 100\% \tag{1}$$

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

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