ELEC-313
Lab 3: Diode Circuits

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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 Ω
Capacitor: 1 µF
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 kΩ	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

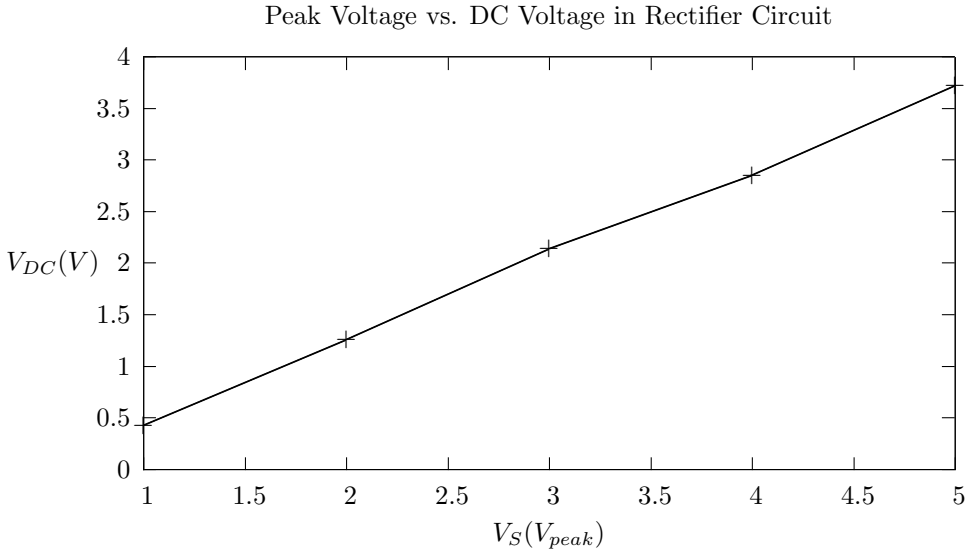

Figure 2: AC input vs. DC output of circuit, where $R_L = 10\,\text{k}\Omega$

				Measured		Calculated		
R_L Ω	V_L V	I_L mA	V_{OC} V	V_S(Drop)Meas(V) V	%reg(VL)	V_{OC}(V) V	%diffVOC	VS(Drop)PSpice(V
100	5.163	50.9	6.10	7.5	4.20%	6.12	0.359%	7.5
330	5.318	15.62	7.87	5.9	1.17%	7.88	0.102%	5.8
1000	5.11	5.27	8.60	5.3	5.28%	8.90	3.327%	5.3
No Load	(inf)	5.38						

Table 3

4.2 Voltage Regulator

5 Results

6 Conclusion

7 Equations

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

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

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