Lab 6:
Diodes

Name: Wan-Yu Liao

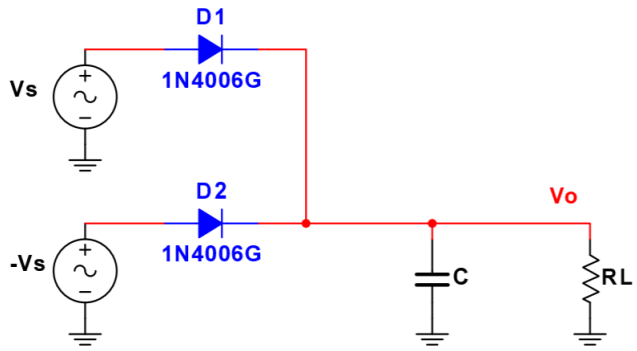
ECEN 325 Section 514

TA: Mandela

Lab Date: October 11, 2019

Lab Report Due Date: October 14, 2019

Calculation



$V_o = 3V$ $V_S = 250\,Hz$

$I_L = 3mA$ Ripple max = 10%

1N4006G has 1V forward voltage drop.

$$R_L = \frac{3V}{3mA} = 1000\Omega = \boxed{1k\Omega}$$

$$V_r = 10\% \cdot 3V = 0.3V$$

Peak output voltage $= 3V + 0.3V = 3.3V$

Peak supply voltage $= 3.3V + 1V = \boxed{4.3V}$

$$C = \frac{1}{2fR_L K_r} = \frac{1}{2 \cdot 250 \cdot 1k \cdot 0.1} = \boxed{20uF}$$

Simulations

(1)

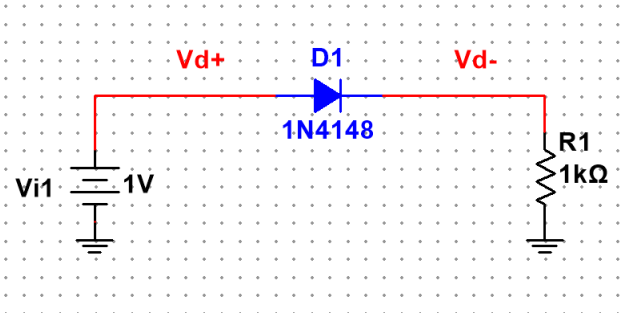


Figure 1: Schematic for Fig. 2(a) ▲

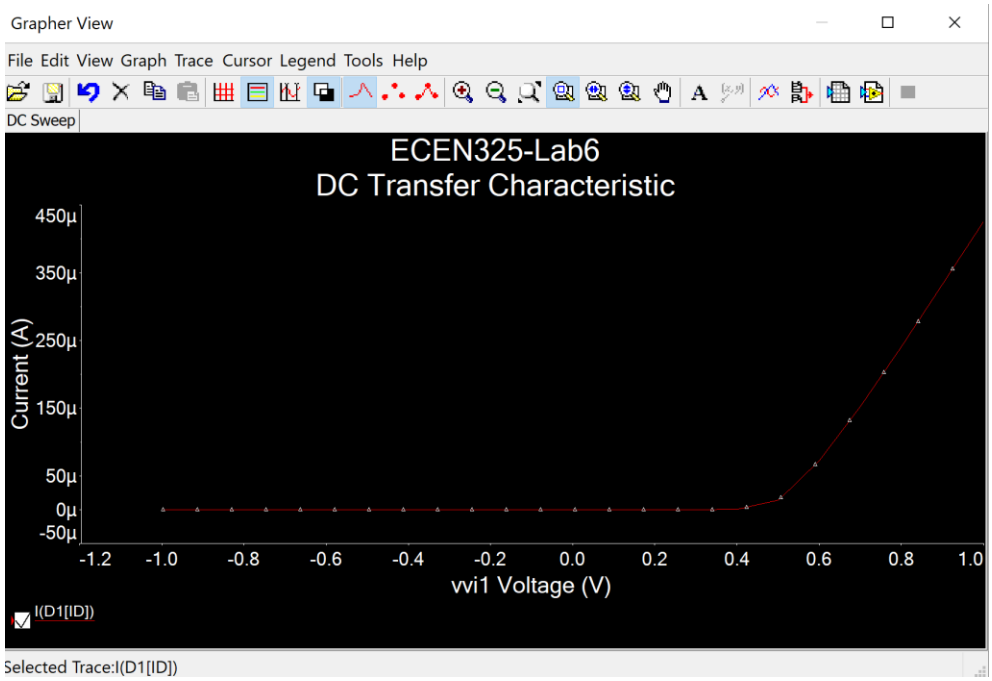


Figure 2: DC sweep simulation plot for Fig. 2(a) where Vstep = 0.1 from -1 V to 1 V▲

	A	B	C
1	X--Trace 1:	Y--Trace 1::[I(D1[ID])]	
2	-1	-1.1E-12	
3	-0.9	-1E-12	
4	-0.8	-9E-13	
5	-0.7	-8E-13	
6	-0.6	-7E-13	
7	-0.5	-6E-13	
8	-0.4	-5E-13	
9	-0.3	-4E-13	
10	-0.2	-3E-13	
11	-0.1	-2E-13	
12	-1.4E-16	-6.7E-28	
13	0.1	4.78E-12	
14	0.2	2.28E-10	
15	0.3	1.09E-08	
16	0.4	5.1E-07	
17	0.5	1.43E-05	
18	0.6	7.23E-05	
19	0.7	0.000153	
20	0.8	0.000241	
21	0.9	0.000332	
22	1	0.000426	

Figure 3: Simulation data for Fig. 2(a) ▲

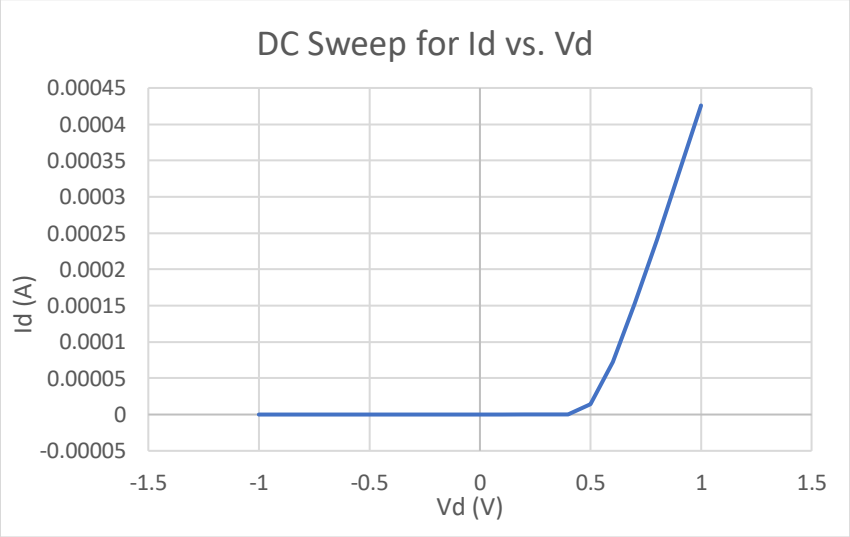


Figure 4: Excel data plot for Fig. 2(a) where Vstep = 0.1 from -1 V to 1 V ▲

(2)

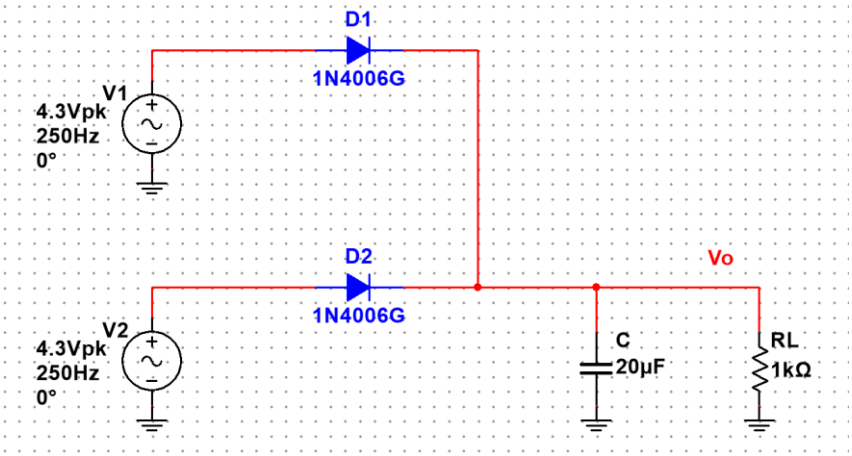


Figure 5: Schematic for Fig. 5 with calculated values▲

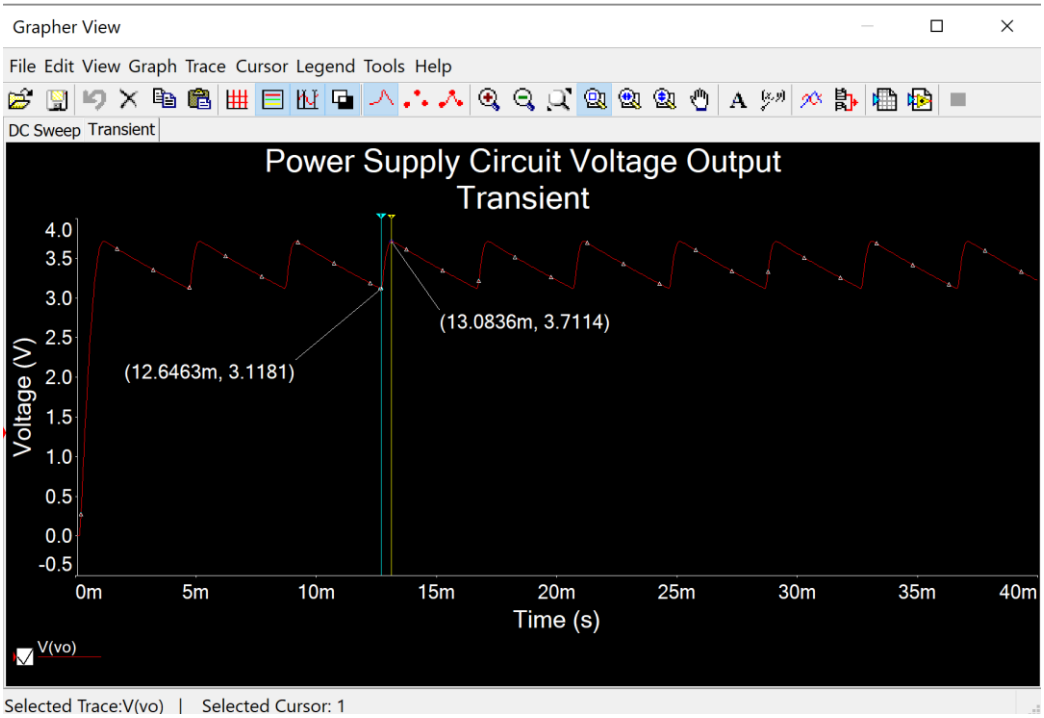


Figure 6: Power supply circuit transient simulation for voltage output▲

Voltage high peak = 3.7114 V, Voltage low peak = 3.1181 V

Max ripple = (3.7114-3.1181)/[(3.7114+3.1181)/2]*100% = 17%

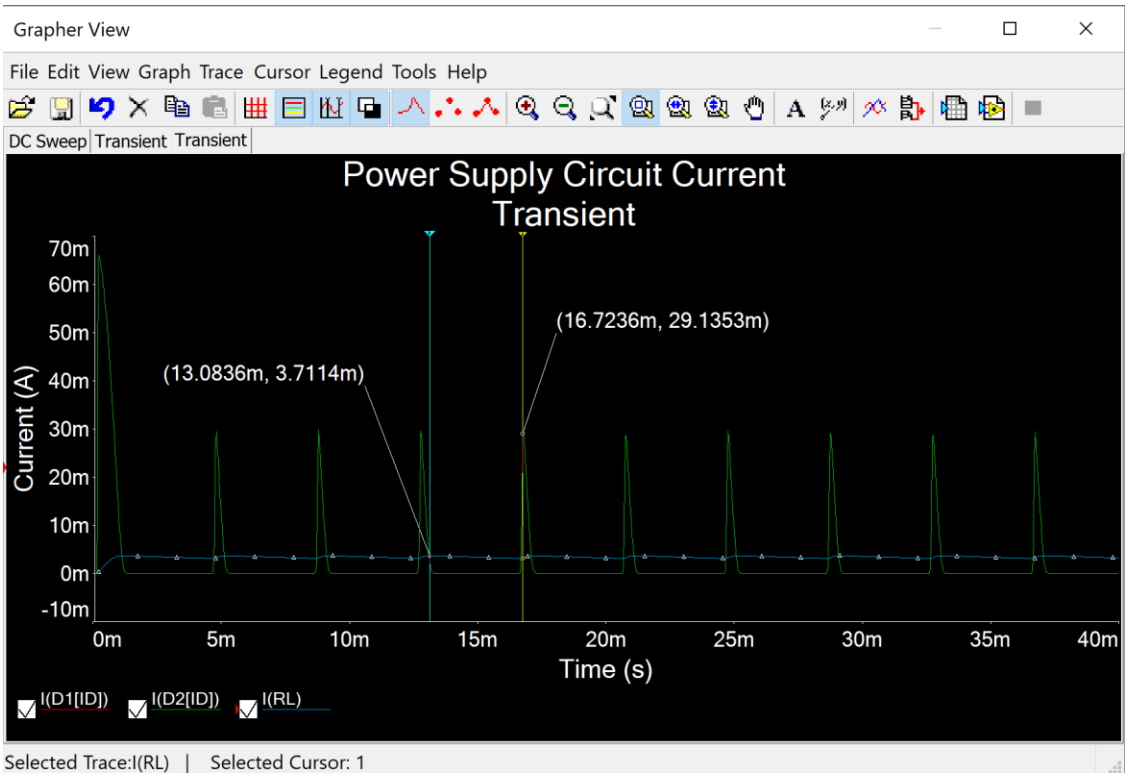


Figure 7: Power supply circuit transient simulation for currents ▲

Peak current on diodes = 29.1353 mA for both D1 and D2

Peak current on load resistor = 3.7114 mA

Measurements

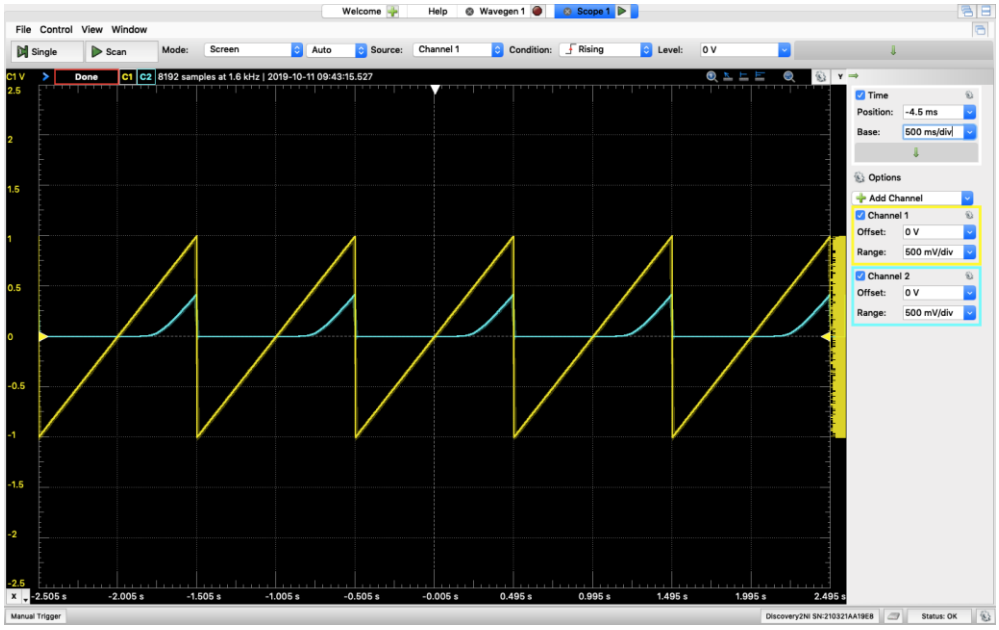


Figure 8: Waveform output for Fig. 2(a) where Vi = RampUp waveform▲

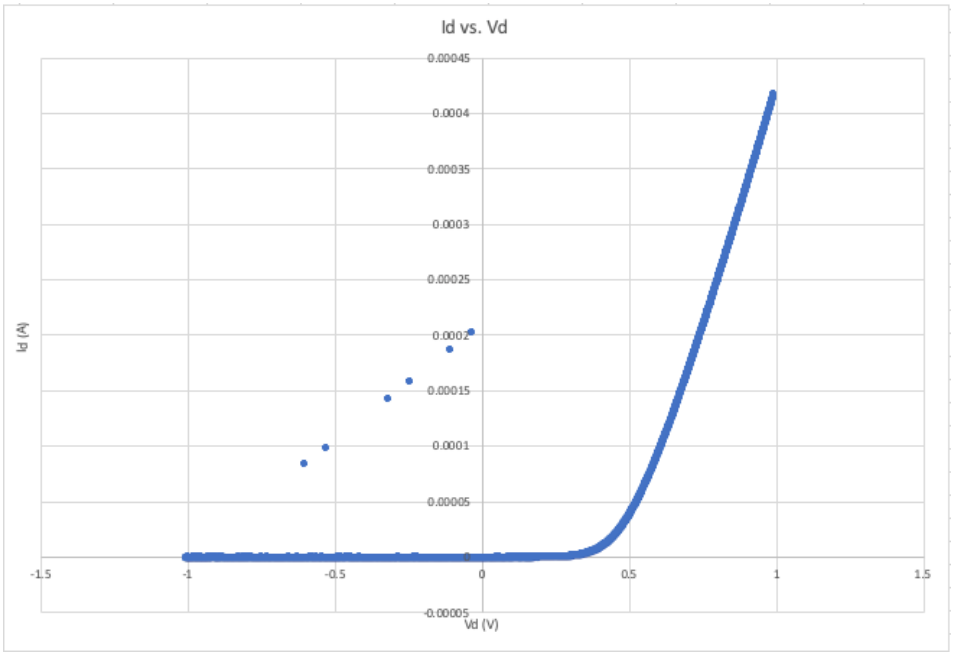


Figure 9: Excel data plot showing current of diode vs. voltage of diode for Fig. 2(a) using data from Figure 8 ▲

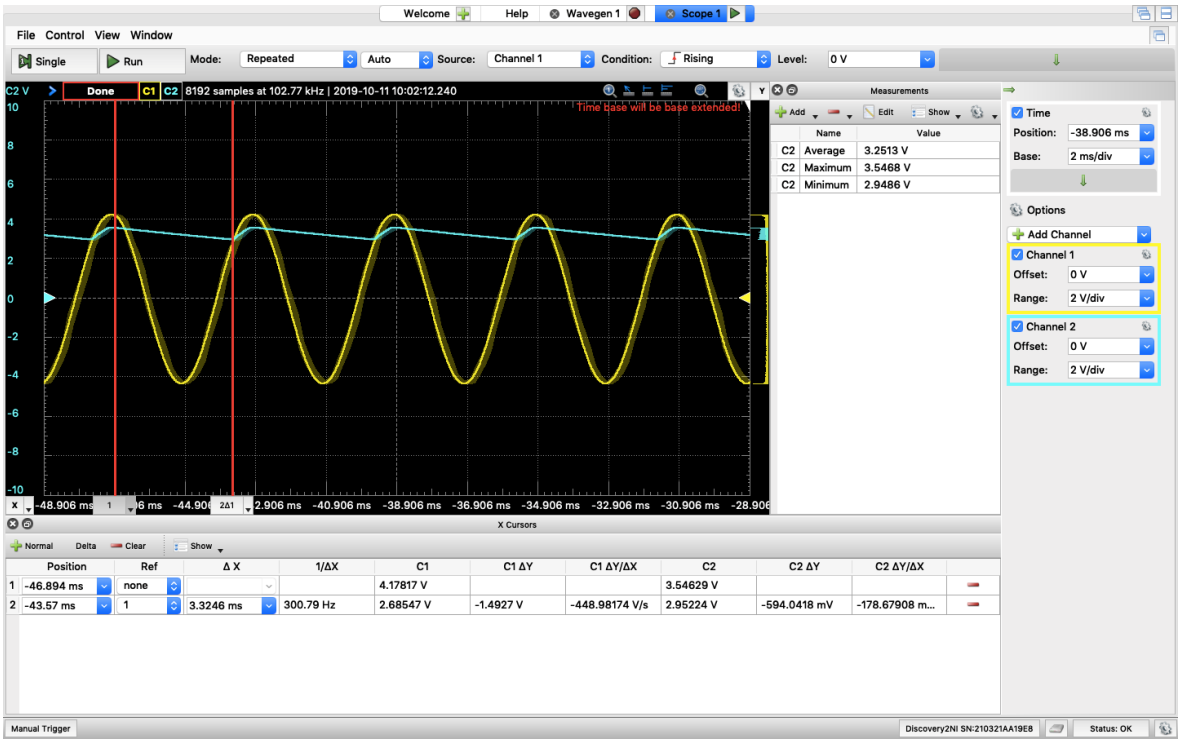


Figure 10: Power supply circuit waveform ▲

Voltage high peak = 3.5468 V, Voltage low peak = 2.9486 V, Voltage Average = 3.2513 V

Max ripple = (3.5468-2.9486)/[3.2513]*100% = 18%

Table

	Calculation	Simulation	Measurement
Peak Output Voltage (High)	3.3 V	3.7114 V	3.5468 V
Peak Output Voltage (Low)		3.1181 V	2.9486 V
Max Ripple	10%	17%	18%

Comment

Based on the table above, the values are very close for calculation, simulation, and measurement parts except for max ripple. Max ripple for simulation and measurement are close but is different from calculation.

For excel data plot of Id vs. Vd, Id started going up at around Vd = 0.4 V for both simulation and measurement. This means that for 1N4148 diode, minimal voltage to turn it on is about 0.4 V which is the forward voltage for 1N4148 diode.