ECE393 – Lab 1

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Labs 1-1 through 1-6 from *Student Manual for the Art of Electronics*.

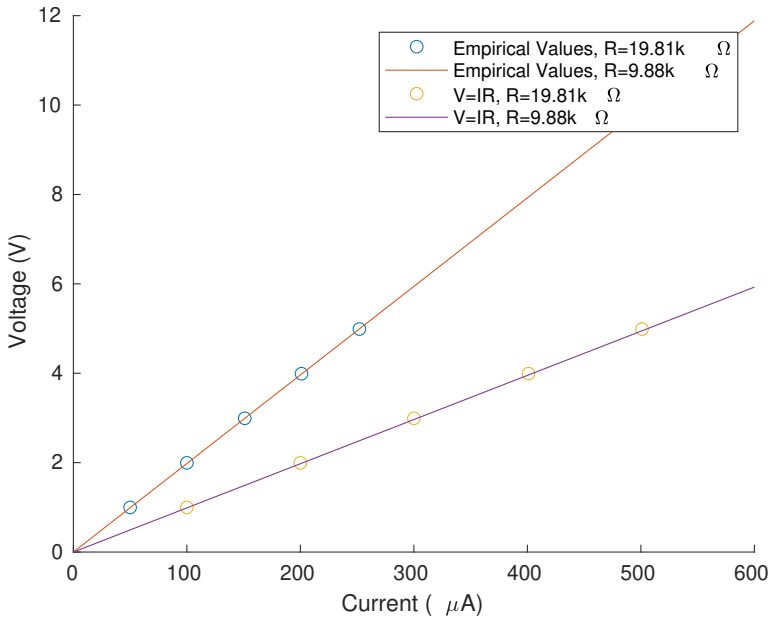
1 Ohm's law

V (V)	I (μA)	V/I (kΩ)
4.989	252	19.8
3.990	201	19.9
2.992	151	19.8
1.995	100	20.0
0.998	50	20.0

(a) $R = 19.81\text{k}\Omega$

V (V)	I (μA)	V/I (kΩ)
4.989	501	9.96
3.991	401	9.95
2.992	300	9.97
1.995	200	9.98
0.998	100	9.98

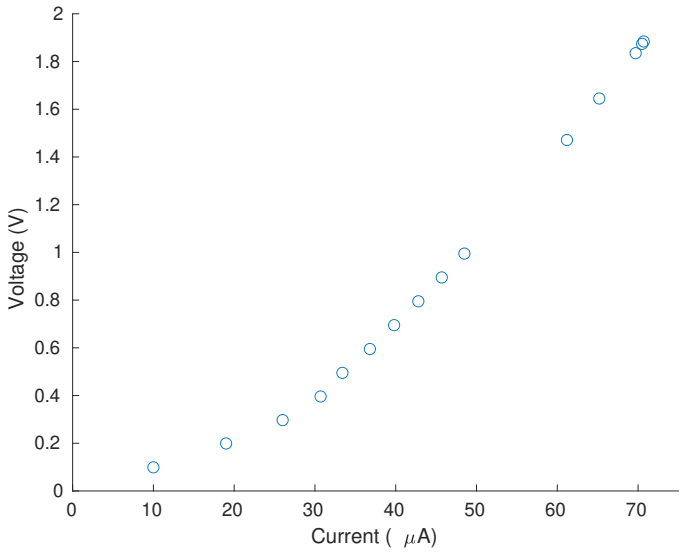
(b) $R = 9.88\text{k}\Omega$



2 An incandescent lamp

The ADALM2000 power supply has a maximum current rating of 50μA. Thus, even if we attempt to set the voltage (V_{att}) to some high values, the actual applied voltage (V_{app}) will drop because the device can't source enough current. The maximum current observed from the device was roughly 70μA.

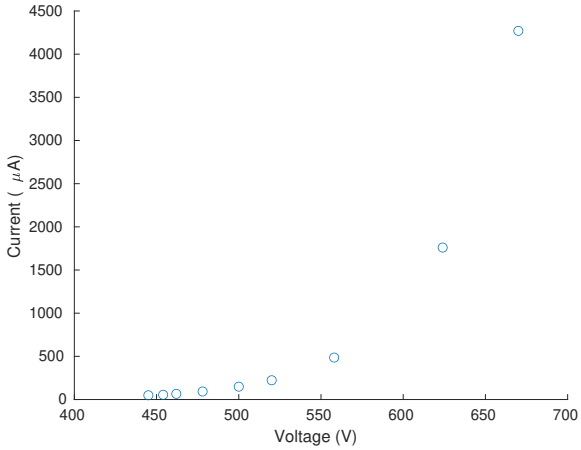
V_{att} (V)	V_{app} (V)	I (μA)	V_{app}/I (kΩ)
5.0	1.884	70.7	26.6
4.0	1.874	70.5	26.6
3.0	1.835	69.7	27.1
2.0	1.645	65.2	25.2
1.5	1.471	61.2	24.0
1.0	0.995	48.5	20.5
0.9	0.895	45.7	19.6
0.8	0.795	42.8	18.6
0.7	0.695	39.8	17.5
0.6	0.595	36.8	16.2
0.5	0.495	33.4	14.8
0.4	0.396	30.7	12.9
0.3	0.297	26.0	11.4
0.2	0.199	19.0	10.5
0.1	0.099	10.0	9.90



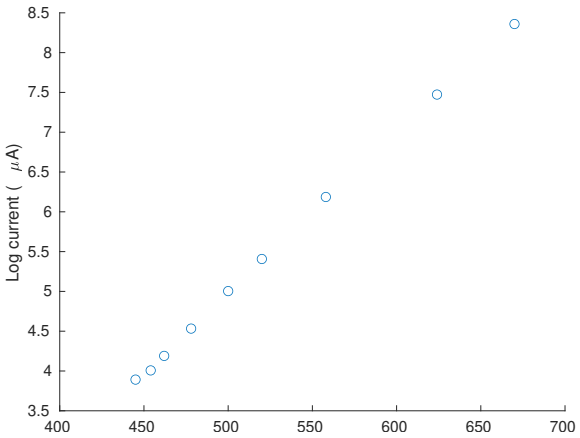
We see a slight nonlinearity (almost linear, not an exponential nonlinearity) in the voltage vs. current curve. For higher currents (and higher voltages), the slope of the chart (the effective resistance) seems to increase.

3 The diode

V (mV)	I (μA)
445	49
454	55
462	66
478	93
500	149
520	223
558	486
624	1760
670	4270



(a) Current on a linear scale



(b) Current on a log scale

It is clear that the I/V relationship of a diode is exponential. If the diode is reversed, then the voltage and current through the diode are both zero.

4 DC Voltage divider

$V_{in} = 5$V rather than 15V because this is the maximum voltage of the ADALM2000 power supply.

	Voltage divider	Thevenin equivalent
S.C. Voltage (Thevenin Voltage) (V)	2.48	2.47
S.C. Current (Thevenin Current) (μA)	493	492
Voltage over 10kΩ load (V)	1.65	1.65
Current through 10kΩ load (μA)	167	166

The Thevenin-equivalent circuit uses a voltage source with the S.C. voltage ($V_{th} = 2.48V$) and $R_{th} = V_{th}/I_{th} = 4.98k\Omega$.

5 AC voltage divider

Using the same circuit setup as the previous section, except that V_{in} is now an AC source with $V_{in,pp} = 10$V, gives almost exactly the same voltage values as the previous example for peak-to-peak voltages. The difference is that it is not straightforward to measure (AC) current values, so we cannot use this to calculate the Thevenin impedance.