Lab 1: Diodes

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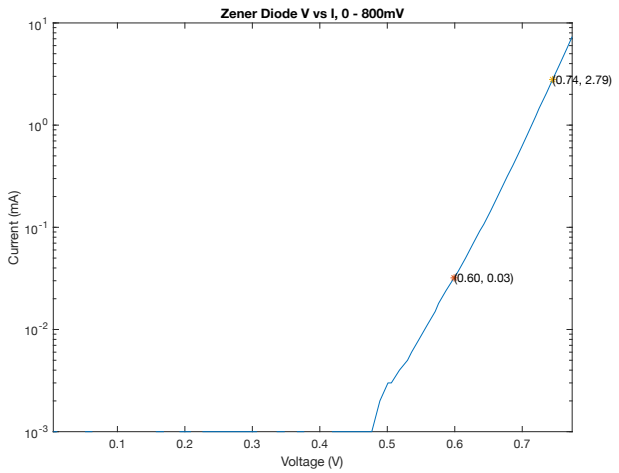
Part I

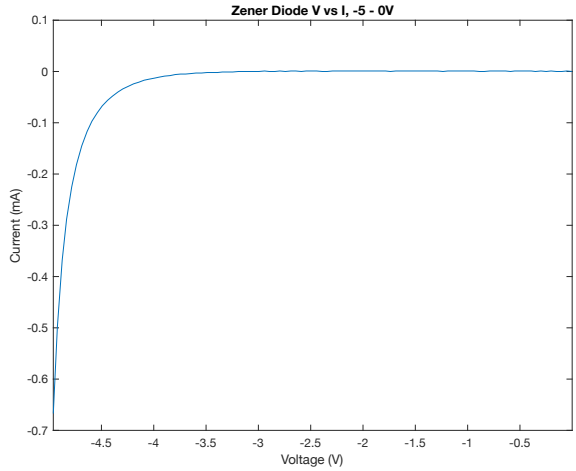
Looking at the graph we get
$a = (0.6V, 0.03mA),\ b = (0.74V, 2.79mA)$. From the points the slope

$$m = \frac{\log_{10}(b_I) - \log_{10}(a_I)}{b_V - a_V} = 14.1$$

was calculated. Hence for a $\times 10$ increase in current, voltage will increase by $\frac{1}{m} = 0.07V$. The slope seems to be equivalent to $\frac{1}{V_T}$ the thermal voltage.

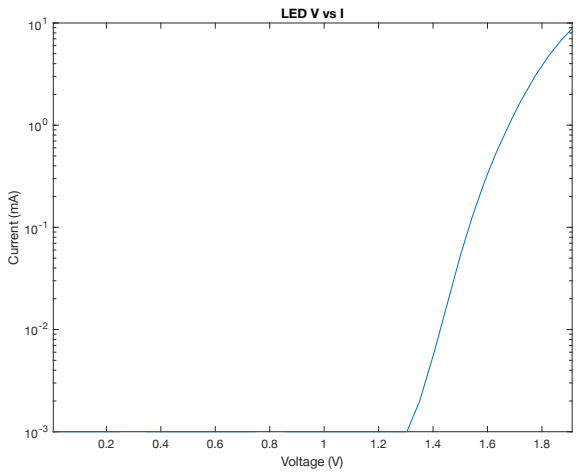


It can be seen from the graph, breakdown starts at about $4.5V$ and occurs quite abruptly.



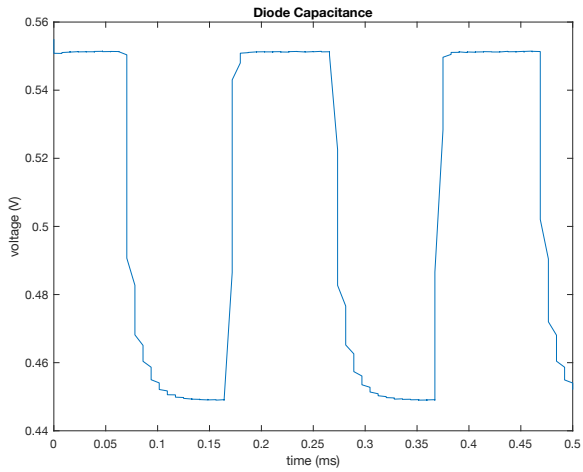
Part II

Led turn on voltage 1.4V, as seen on graph.



Part III

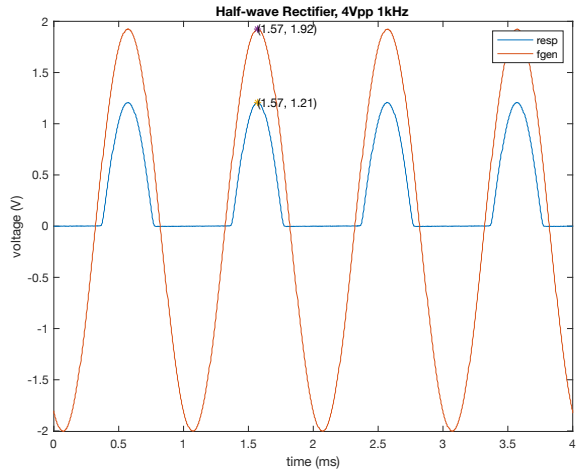
$V_{max} = 551\text{mV}$
$V_{min} = 449\text{mV}$
$V_{discharge} = V_{min} + 0.367(V_{max} - V_{min})$
$V_{discharge} = 489\text{mV}$
$dt = 10^{-5}\text{s}$ (From measured data)
$RC = dt$ where $R = 100\text{k}\Omega$
$\therefore C = 100pF$

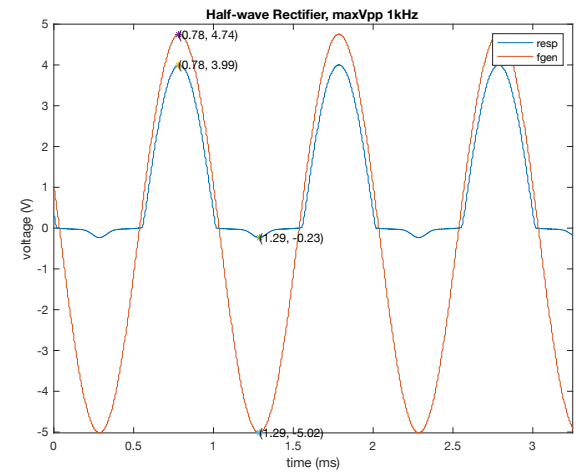


Part IV

$V_{out} = 1.2\text{V}$
$dt_{out} = 56\mu s$

The output waveform does not follow the input waveform as the output does not allow the negative portions of the input cycle to pass. This is because $IV_{in} < V_D$ which results in $V_{out} = 0$ for the negative cycle. Meaning the diode does not conduct. The flat portion of the waveform indicates this.





Part V

$V_{in} > V_{breakdown}$

$V_D = V_{FGN} - V_R = V_{in} - V_{out}$
$= breakdown$

As the diode is flipped form the previous questions, for the positive cycle, the diode is in reverse breakdown. However in the negative cycle, in order for the diode to conduct, $V_{in} > V_{turnon}$ is needed.

$V_{in_{max}} = 9.1\text{V}$
$V_{out_{max}} = 3.9\text{V}$
$V_{in_{min}} = -9.5\text{V}$
$V_{out_{min}} = -8.5\text{V}$

This gives a forward voltage drop of $V_D = 9.1 - 3.9 = 5.2V$.