Laboratory 6: Photovoltaic and LED Circuits

Part1:

1. Plot current vs voltage for each of the four different colors of LEDs (place the LEDs in series with a 330Ω resistor.

2. Fit a line to the higher current measurements for each LED and use the equation for this line to estimate both $V_{turn\ on}$ and the resistance of the diode when conducting.

3. Plot $V_{turn\ on}$ on vs $1/\lambda$ for these four LEDs and use the slope of this line to determine the value of Planck's Constant. Be sure to constrain the line to pass through zero - zero. Compare your result to the accepted value.

Part 2:

1. Measure the temperature of the infrared LED at a variety of currents (I<100mA).

2. Convert the apparent temperature measurements for the infrared LED taken with the infrared camera to Kelvin.

3. Plot current vs T as well as current vs $T^{1/4}$.

4. Which plot fits a straight line better? Explain why this makes physical sense.

5. Plot the current versus luminosity measured with the LoggerPro light meter for the green LED. Comment on the shape of this curve based on what we know about the behavior of solar cells under illumination.

Part 3:

1. Plot open circuit voltage vs the natural log of the light intensity for the individual solar cell you used. Make a separate plot for the incandescent light bulb and for the compact fluorescent bulb. Fit a line to each curve.

2. Based on what you know from Physics of Renewable Energy about the relationship between open circuit voltage and the short circuit current (which is proportional to the light intensity) for a solar cell, explain the shape of these two curves. Make your best estimate of the dark current I_o for the solar cell using both the incandescent light bulb and the compact fluorescent bulb.

3. The compact fluorescent bulb appeared far brighter to us than the incandescent bulb. Explain why the solar cell you used showed a higher voltage (i.e. a higher light intensity) for the incandescent bulb than the CFL.