Lab Quiz 1 for PHY324

Q1: What experiment are you doing?

Thermistors and Silicon Diodes

Q2: Summarize the physics elements in this experiment.

1. For the Thermistors part of this lab, I will be using a Thermistor to measure temperature. I can do this since Thermistors are temperature sensitive resistors, that usually exhibit a negative temperature coefficient of resistance (NTC). The electrical resistance of a thermistor will be reduced when it is placed in a medium of higher temperature. The thermistor will not read a temperature, but we can infer a temperature based on how the resistance changes.
2. For the Diodes part of this lab, I will use Silicon Diodes. Diodes are basic unidirectional semiconductor devices that will allow current to flowthrough them in one direction only. The process of adding donor or acceptor atoms to the semiconductor, in the order of 1 impurity atom per 10 million (or more) atoms of the semiconductor, is called doping. Doping allow us to create an excess of current-carrying electrons, which will allow us to create a silicon diode with P and N poles that allows easy follow of current in one direction but not the other.

Q3: Describe one major goal of the lab.

1. For the Thermistors part of this lab the main goal is to find a relation between the temperature of the Thermistor and its electrical resistance.
2. For the diode part of this lab the main goal is to find the constants I\_o and Boltzmann’s constant “k” in equation 5 of the lab handout (Shockley diode equation).

Q4: What do you measure directly in pursuit of the major goal described above?

1. What will be measured is the electrical resistance of the Thermistor, using an ohm meter, at different temperatures.
2. What will be measured is the current in both the forward bias (in miliAmps) and reverse bias (in microAmps) directions using an ammeter, while varying the voltage of the power supply. This voltage will also be recorded using a voltmeter. The diode, ammeter and power supply will are wired in series, and the voltmeter is wired across (in parallel) the diode.

Q5: Outline how you get the answer to Q3 from the data collected as described in Q4. If you will graph data to achieve the goal in Q3 then explain what you will graph, what the trend-line will look like, and how it achieves the goal in Q3. Include any equations you will use to turn the data described in Q4 into the answer described in Q3.

1. To find this relation we use the Steinhart-Hart Equation. We take its inverse and treat it as a polynomial of degree 3 in ln(R). Doing this we can then write a python program that will fit the collected data to this polynomial via least-squares using curve\_fit from scipy. The fitting will give us our 4 coefficients which we can use to create the calibration curve for the thermistor of the form of equation 4 in the lab hand out.
2. To find these constants we will take the current and voltage measured and plot the I-V curve for both forward and reverse bias current. We then fit the Shockley diode equation to this curve using a similar method to the one outlined above (python program using curve\_fit). We can then find the two constants we are looking for.

Q6: Your TA asked you a/some question(s) about the equipment. Write the question(s) and answer(s) here.