Physics 517/617 Experiment 1
Instrumentation and Resistor Circuits

Report Due July 6, 2010

Basic Experiment - Physics 517/617

Study the operation of the oscilloscope, multimeter, power supplies, and wave generator. For the oscilloscope you should understand the function of all the knobs on the front panel.

In what follows, you should make measurements as precisely as you are able. In most cases you should be able to measure to better than 1% precision. DO NOT, for example, just read the voltage off the voltage power supply. But rather *precisely measure* the voltage using a voltmeter/multimeter.

1) Investigate Ohms law by plotting current vs voltage --- i.e. make an I-V curve --- for a resistor between 300 Ω and 500 Ω. Calculate the power into the resistor for each measurement and measure for voltages/currents that give powers up to 50% *above* the rated power of the resistor. Repeat the measurement with a resistor 100 X higher than the previous resistors using all voltages you can get from your power supply. Use a DC power supply. *Discuss how well Ohms "Law" is obeyed by these resistors and any departures from it that you observe. Save the 1st resistor for part 3), below.*

2) Consider modeling a light bulb as a resistance and repeat part 1 using a light bulb (don't put more than the rated voltage across the light bulb).

3) Measure the I-V curve for a) a regular diode and b) a Zener diode. For both measurements, to protect the diode, you should put the resistor you used in part 1) *in series* with the diode before connecting it to your voltage supply. Before you start making measurements explain --- write in your lab notebook --- how this protects the diode AND how you could use this resistor that you "calibrated" in part 1) to measure currents. Also for the "reverse bias case," the current through the diode is small but not exactly zero. Suggested trick: to measure the small current through the diode, use a large resistor in series with the diode and measure the voltage across it.

4) Use a resistor divider network to measure the DC resistance of the multimeter (use voltage scale).

5) Design and build a circuit with the following specs:

a) four or more resistors (all different) resistors in series and parallel

b) circuit draws between 10 and 50 milliamps when connected to 5 V DC.

Calculate and measure the voltage drop and current through each element in your circuit. Calculate the power dissipated by each resistor and compare the total to the power out of the voltage supply.

6) Use the oscilloscope to check the frequency calibration of your function generator. Start at about 10 Hz and go up to the highest frequency available. Plot the results. To have the results fit on one plot you shou plot $\log(f_1)$ vs $\log(f_2)$.

7) Use a resistor divider network to measure the input resistance of your oscilloscope. Determine the effective value of R and compare with the 'scopes spec sheet.

8) Use the oscilloscope to measure the output resistance of your function generator.