Department of Computer and Electronics Engineering Technology

CEET 1140

Lab 2

Title: Ohm's Law.

Objective: The student will be able to verify ohm's law by examining the relationship of the voltage across the resistor and the current through it. The student will also be able to plot the i-v curve for a resistor and compute the resistance from it.

Equipment:
Power Supply
Clip Lead
Digital Multimeter (2)
Proto Board

Parts:
1 100 Ω Resistor, 5% tolerance (wattage determined below)
1 330 Ω Resistor, 5% tolerance (wattage determined below)

Preparation: Write the title and a short description of this lab in your lab book. Make sure the page is numbered and make an entry in the table of contents for this lab.

For each resistor, above, calculate the current flow and the and power dissipation you would expect if the voltage across the resistor is 5v (the highest voltage we will use in this lab). Remember to include your formulae and to put these data in a table.

Select resistors for this lab that are rated greater than or equal to the wattage you calculated.

Bring your lab notebook and the parts, above, to your lab period.

Set up: Configure the multimeter as an ammeter. With the power supply off, connect leads (a) from the (+) terminal of the power supply to one terminal of the multimeter, (b) from the other terminal of the multimeter to one lead of the 100 Ω resistor, and (c) from the other lead of the resistor to the (–) terminal of the power supply. Turn the voltage and current knobs of the power supply all the way counterclockwise and switch the display to volts.

Procedure: Turn on the power.

Turn the current knob clockwise a half turn. Then carefully turn the voltage knob clockwise until the voltage (on the power supply) reads 1.0 volts. Using a second multimeter configured as a volt meter, measure the voltage directly across the resistor (not the power supply). Make note of (a) the voltage and (b) current (from the multimeters). Then compute (c) the power dissipated by the resistor, and (d) the ratio of voltage to current (v/i). Record these values in a table in your lab book. Repeat the process for voltages around 2.0, 3.0, 4.0 and 5.0 volts.

According to Ohm's law, R = v/i. Since R is supposed to be constant, all the values of v/i you recorded should be about the same ($\approx$100 Ω). Verify that this is true.

Plot current vs. voltage on graph paper in your lab notebook. Draw a line that goes as near as possible to all the points. A good way to estimate the resistance is to find the slope of this line (which is actually the conductivity) and reciprocate it. To find the slope of the line, choose 2 points on the line and compute the slope, m:

$$m = \frac{\Delta current}{\Delta voltage}$$

Note that m is the conductivity (in Siemens) of the resistor. Calculate the resistance by computing $1/m$. Record all calculations in your lab book.

Plot dissipated power vs. voltage on a similar graph.

Without adjusting the power supply except to turn it off while exchanging resistors, repeat these measurements, graphs and calculations for the 330 Ω resistor.

Turn off the power supply and Configure the digital multimeter as an ohm meter. Measure each of the resistors and compute the error (in percent) relative to the resistance you computed earlier. Record these data (measured resistance, computed resistance and error) in a table in your lab book.

Cleanup: Turn off the power. Configure both multimeters to be voltmeters.

Conclusions: What two properties do the i-v graphs of the 100 Ω and the 330 Ω resistors have in common? In what one way do they differ?

The power graph is not linear. What kind of curve is it?

If you calculate that you need a ¼ watt resistor, is it a problem to use a ½ watt resistor if that is all you have available?