IT 327 - Lab #2
Parallel Circuits & the Power Formula; Electronic Measuring Equipment

Objective

There are two objectives in this lab. The first is to give students a chance to observe the basic relationships of combining loads in parallel, and to observe the relationship described by the power formula. The second objective is to experience some of the problems associated with using electronic test and measuring equipment, and to gain experience using the oscilloscope and function generator.

Equipment Required

For the first objective, you will need a few assorted resistors, a DC power supply, and a DMM (Digital Multi-Meter). Resistors: 100Ω, 330Ω, 1kΩ. For the second objective, you will need a DMM, an oscilloscope, a function generator, a DC power supply, and two 10 MΩ resistors.

Procedures, Objective #1

Be sure to take plenty of pictures and include them in your write-up with an appropriate caption.

1. First measure the resistance of each of your resistors using the DMM. As you did in the previous lab, determine how close each resistor is to its rated value, and whether it is within its rated tolerance.

To observe the effects of combining resistors in parallel, do the following:

2. With the DC power supply set to +5V, connect the 1kΩ resistor and measure the current.
3. Now add the 330Ωresistor in parallel with the 1kΩ resistor and measure the total current. Did the current go up or down? Calculate the expected current for the parallel combination and compare this value to the measured current. Were the results as expected?
4. Now add the 100Ω resistor in parallel with both the 1kΩ and the 330Ω resistors, and measure the total current. Did the current go up or down? Calculate the expected current for the complete parallel combination of three resistors and compare this value to the measured current. Were the results as expected?
5. Calculate the expected current in each of the three branches of the above circuit, using the current divider method or using Ohm's law. Measure the branch currents and compare to the calculated values.

To observe the relationship described by the power formula:

6. Calculate the power being dissipated by each resistor in step 5. Feel the heat being dissipated by each resistor and determine if it agrees in rank as you would expect for each resistor. (Which one is the hottest? Which is the coolest? Is this as you expected?)

Procedures, Objective #2

1. Measure the actual value of the two 10 MΩ resistors.
2. Set the DC supply to +10 Volts, and apply to the two 10 MΩ resistors connected in series. Calculate the voltage you would expect to measure across each resistor, respectively. After calculating the expected voltage measurements, measure each, determine the % difference from the expected values, and explain the difference.

3. Set the function generator to 10 kHz, 10 $V_{p\text{-}p}$, sine wave, using the DMM to set the frequency and the amplitude. Be sure to turn the offset (symmetry) of the function generator to OFF.
4. Measure the amplitude and frequency of the 10 kHz sine wave using the oscilloscope. Include in your write-up all the units the oscilloscope gives for these measurements.
5. Calculate the voltage you would expect to measure across each resistor and across both resistors, with the 10 kHz, 10 $V_{p\text{-}p}$ signal applied, for the oscilloscope.
6. Apply the above output of the function generator to the 10 MΩ resistors (remove the DC voltage). Using the oscilloscope, observe the voltage across both resistors, and the voltage across the resistor closer to ground. Do not try to measure the voltage across the other resistor. Compare the measured values to the expected values.

Report and Conclusion

Tell what this lab has taught or reinforced. Try to be insightful in recognizing the things you really did learn or verify. Part of this lab was intended to show that errors in measurements can be due to the measuring equipment being used. Discuss the sources of error in your measurements. Also discuss the operation of the oscilloscope and function generator, their capabilities and limitations.