Electric Circuits Laboratory

LAB EXERCISES

********** LAB 2 **********

1 WIRE, RESISTORS, & DMM

I. Equipment needed

A. Lab partner: _____
B. Wire – white wire (22 AWG), 1 piece each
C. Wire cutter/stripper
D. Resistors
   1. Set 1: 3 known (1.8k, 4.7k, 100k)
   2. Set 2: 3 unknowns (_____,_____ , _____),
E. Digital multi-meter (_____)
F. Calipers (there is only 1 set of calipers for the whole class, so you must share!)

II. Wire

A. Using wires
   1. Wire is designed to conduct electric current with very little resistance.
   2. Wire comes in various sizes and styles.
   3. There are 2 basic types of wire, solid and stranded.
B. Using the cutter/stripper
   1. BE CAREFUL! Keep your fingers away from the cutting & stripping area of the tool.
   2. Only use 22 AWG wire or smaller (i.e., bigger AWG value)
   3. Use the wire cutter/stripper to cut ~3/4 inch length from the wire.
   4. Now "strip" (or remove) ~3/4 inch of insulator from the wire (do not cut the metal!). Use the "22" area of the tool.
C. Measuring wire size using calipers
   1. Measure the diameter of stripped white wire & record value _____.
   2. Measure the diameter of resistor "lead" wire & record value _____.
   3. Measure the diameter of a wire from the assorted pack & record value _____ .
   4. What is the corresponding AWG value(see your lab handout)
      a. Stripped white wire _____.
      b. Resistor lead _____.
      c. Wire from assorted pack _____.

III. Resistor Color Codes

A. Known resistors – you will be provided with 3 resistors (R1 – R3) with given resistance values (Set 1). Use the color bands to figure out the "nominal" resistor values.
   1. Record the color bands of the 3 resistors
      a. R1 = _____.
      b. R2 = _____.
      c. R3 = _____.
   2. Convert colors into 3 numbers indicating 'nominal' resistance & tolerance ("^" means power, so 10^2 = 10^2).
      a. R1 = _____ _____ x 10 ^ _____ ± _____
      b. R2 = _____ _____ x 10 ^ _____ ± _____
      c. R3 = _____ _____ x 10 ^ _____ ± _____
   3. Record the nominal R values to kΩ. Are the values consistent with given R values?
      a. R1 = _____.
      b. R2 = _____.
      c. R3 = _____.

IV. DMM (digital multi-meter)

A. Using the DMM
   1. Plug the black probe into the "COM" port on the DMM. The red probe goes into one of the other "red" ports, depending on what electrical variable you are measuring.

B. Measuring 1 R on DMM at different range settings.
   1. Select the 1.8 kΩ resistor.
   2. Set DMM to "Ω" & 200. What does display show? _____.
   3. Set DMM to "Ω" & 2k. What does display show? _____.
   4. Set DMM to "Ω" & 200k. What does display show? _____.
   5. Set DMM to "Ω" & 20M. What does display show? _____.

C. Measuring Resistance
   1. Take the 3 resistors from above & measure the "actual" resistance using the DMM. Record the measured resistor values, DMM settings used, and the % difference ("diff") from "nominal" using the equation below

$$\%\,diff = \frac{R_{measured} - R_{nominal}}{R_{nominal}} \times 100$$

      a. $R1_{nominal}$: _____. $R1_{actual}$: _____. DMM setting _____. % diff _____.
      b. $R2_{nominal}$: _____. $R2_{actual}$: _____. DMM setting _____. % diff _____.
      c. $R3_{nominal}$: _____. $R3_{actual}$: _____. DMM setting _____. % diff _____.

   2. Take resistors of Set 2 (R4 – R6) having UNKNOWN resistance value.
   3. Record the color bands below, & translate into nominal resistance values (show work)
      a. R4 = _____.
      b. R5 = _____.
      c. R6 = _____.

4. Measure the R values using DMM, record values, DMM settings used, & % diff as you did above.
   a. $R4_{nominal}$: _____. $R1_{actual}$: _____. DMM setting _____. % diff _____.
   b. $R5_{nominal}$: _____. $R1_{actual}$: _____. DMM setting _____. % diff _____.
   c. $R6_{nominal}$: _____. $R1_{actual}$: _____. DMM setting _____. % diff _____
   .

D. Finishing – clean up your area and check out with instructor (Instructor initials: _____)

V. Follow-up questions

A. What is the best DMM range setting to measure a 2.2kΩ resistor?_____.
B. What is the best DMM range setting to measure a 270kΩ resistor?_____.
C. The R with colors: red, red, violet, & silver has resistance = _____MΩ.
D. Our protoboards can only accept size up to 22 AWG.
   1. Can the white wire be used on these boards? _____
   2. Can the resistor lead wire be used on these boards? _____
   3. Can the wire from the assorted pack used on these boards? _____
E. Provide an explanation as to why you can get a reading on some settings on the DMM, but not for others.

_____.
_____.
_____.