**Series & Parallel DC Circuits Resistors**

**Experiment**

**6**

**Introduction:** This exercise is designed to give you experience in setting up and making measurements on DC circuits. This will include using the multimeter, drawing and using circuit diagrams, using a variety of power supplies and other necessary circuit elements, and using the PROTO-BOARD to build DC circuits. More specifically, you will experimentally verify:

1. The equivalent resistance equation for ohmic DC circuits involving resistors in series.
2. The equivalent resistance equation for ohmic DC circuits involving resistors in parallel.

**Theory:** Using your text as a reference, show complete derivations for each of the following equations:

1. The equivalent resistance of a DC circuit that has three different resistors in series in terms of the values of the resistances. Be sure to draw a circuit diagram that includes a DC power supply, voltmeter (connected to measure the equivalent resistance), and an ammeter.
2. The equivalent resistance for three different resistors in parallel. Draw the corresponding circuit diagram.

**Procedure:**

1. The Circuit Board: A convenient way to set up circuits is with a "PROTO-BOARD". In order to use this device, you need to know how it is "bused", which is not shown on the board. Using an ohmmeter, establish the bus lines of this board (How will you do this?) and show them on the first board diagram provided on page 4
   1. Choose three 1/4W resistors. Place them in series on the PROTO-BOARD and measure their resistances with the multi-meter.
   2. You will hook up a power supply, ammeter and voltmeter. **First** calculating the maximum current.
      1. Imax, series =
   3. Use this to determine maximum voltage
      1. Vmax, series =
   4. Hook the power supply to the PROTO-BOARD at a value under the maximum voltage. Measure the supplied voltage, Vs
   5. Measure the current through the resistors.
   6. Measure the potential differences across each individual resistor.
2. Repeat procedures a-e above for three different resistors in parallel. You may use the same three resistors.
   * 1. Imax, par =
     2. Vmax, par =

**Data and Results:**

1. Resistors in Series

R1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ R2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ R3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Vs = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ I = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

VR1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ VR2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ VR3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a. Req, m = Vs/I = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Rth  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

% Error of Equivalent Resistance = \_\_\_\_\_\_\_\_\_\_\_\_

b. Energy Conservation

VR1 + VR2 + VR3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ % error (with Vs) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Resistors in Parallel

R1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ R2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ R 3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

V = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ I = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

R eq,m = V/I =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Rth = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

% Error of Equivalent Resistance = \_\_\_\_\_\_\_\_\_\_\_\_

# Proto-Board Diagrams

**Diagram 1: Bus lines**

**Diagram 2: Resistors in series and parallel**