

Experiment 1

Introduction to Laboratory Instruments and Circuit Elements

1.1 Objectives

In this experiment, you will learn:

1.
 - Reading the color codes of resistors.
 - Using a multimeter for resistance measurements
 - Identifying the differences in analog and digital multimeters.
2.
 - Identifying and measuring the internal battery voltage of analog and digital multimeters.
 - Comparison of the internal batteries of analog and digital multimeters.
3. Measuring the AC line voltage.
4. Measuring DC currents and voltages with a digital multimeter in a resistive circuit.
5. Functioning of a rheostat.
6. Determining the terminal characteristics of linear and non-linear resistors.
7. Difference between a carbon resistor and a power resistor.
8. Functioning of a variac.
9. Characteristics of resistors in parallel and in series.

1.2 Equipment List

1. Analog multimeter
2. Digital multimeter
3. Breadboard
4. Variac
5. Carbon resistors: 1 K, 4.7 K, 18 K
6. Diode: 1N4007
7. Potentiometers: 1 K POT, 10 K POT
8. Power resistors: 500 Ω /60 W, 1 K/60 W
9. Rheostat: 440 Ω

1.3 Preliminary Work

Study the sections;

- Types of Resistors
- Types of Capacitors
- Types of Inductors
- Types of Transformers

- Notes on Multimeters

of the supplementary notes.

1.4 Experimental Work

1. Make sure that you have the necessary instruments and components.

2.

a) Read the color codes and determine the nominal value and tolerance of each carbon resistor and record them.

b) Measure the values of the resistors with the digital multimeter and record them.

3. Measure the minimum and maximum resistance values of the 1 K POT and the 10 K POT potentiometers using the digital multimeter.

4.

a) Set the analog multimeter for resistance measurement. Measure the internal battery voltage of the analog multimeter using the digital multimeter at different ohmmeter scales. *Do not forget to indicate the polarity of the voltage.*

b) Repeat the Part 4.a by exchanging the multimeters, i.e., measure the value of the internal battery of the digital multimeter by the analog multimeter at different ohmmeter scales. Note the differences between the two cases and comment on them.

5. Set the analog multimeter to AC voltage measurement and measure the line voltage. Be sure that the multimeter is in the 500 V AC.

6. Set up the circuit of Figure 1.1. Measure and record all the currents and the voltages using the digital multimeter.

7. Setup the circuit of Figure 1.2 to measure the resistance of a carbon resistor (Use a $4.7\text{ k}\Omega$ resistor as R). Initially, set v' to its minimum value using the rheostat. Then vary the rheostat position so that the value of v is 0, 3, 6, and 9 volts, in turn. For each case measure and record i .

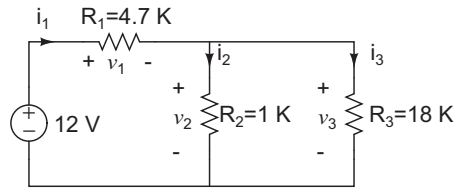


Figure 1.1: Schematic of the circuit in 6

- a) Plot i vs. v graph and determine the resistance R .
- b) Measure and record the resistance R using the analog multimeter.
- c) Measure and record the resistance R using the digital multimeter.
- d) Compare the results obtained in the Parts 7.a, 7.b, and 7.c.

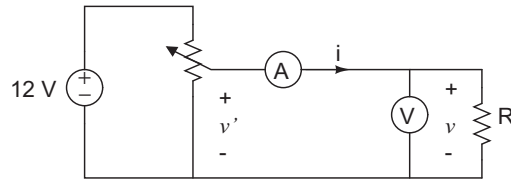


Figure 1.2: Schematic of the circuit in Part 7

8. Setup the circuit of Figure 1.3 by replacing the resistor of Figure 1.2 with an 1N4007 diode. Vary the rheostat position so that the value of i takes the value of 0 A, 10 μA , 100 μA , 500 μA , 1 mA, 4 mA, and 10 mA in turn. For each case measure and record v . Plot the i vs. v graph.

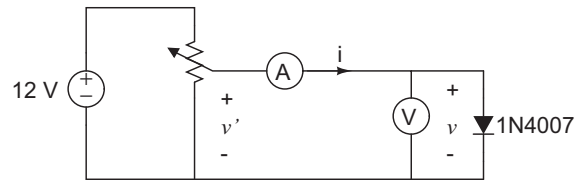


Figure 1.3: Schematic of the circuit in Part 8