Experiment No.3

The Measurement of Unknown Resistance

Object

To find the value of an unknown resistance by using a compression.

Theory

If a current pass through a resistance, a voltage will be setup across that resistance, which is equal to (V=I*R). This voltage drop will be constant as long as the circuit current remaining constant. Now for the series circuit in Fig.1, the current through the electric circuit is the same through each resistance and equal to:

$$I = \frac{V_1}{R_x} = \frac{V_2}{R} = \frac{V_3}{R_{var}}$$

And $I = I_{Total}$

Where:

- R: the known resistance.
- R_x: the unknown resistance.
- R_{var}: the variable resistance.
- V_1: the voltage across R_x
- V_2: the voltage across R
- V_3: the voltage across R_{var}

Hence:

$$\frac{V_1}{R_x} = \frac{V_2}{R}$$ Which leads to

$$R_x = \frac{V_1}{V_2} * R$$

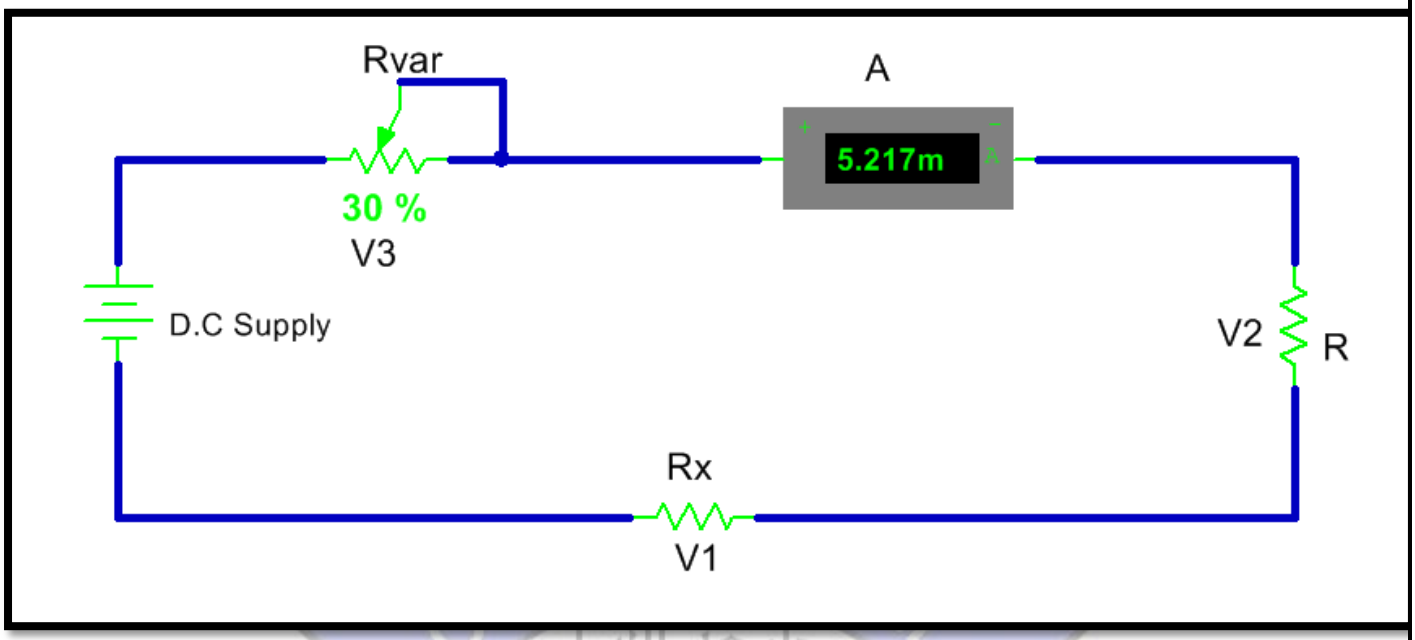

Fig.1

Apparatus

1. Variable resistance.
2. Tow resistance.
3. Voltmeter and ammeter.
4. D.C power supply unit.

Procedure

1. Connect the circuit shown in Fig.1
2. Adjust the D.C power supply voltage to read (5 volt).
3. Vary the variable resistance as the values in the first column of table (1), for each step measure the series circuit current, the value of V_1 and V_2. Record the measured data in table (1).
4. For each step of R_{var}, calculate the value of the unknown resistance using comparison method and Ohm's Law. Record the result in the fifth and sixth columns of Table (1).

R variable (Ω)	I (mA)	V1 (Volt)	V2 (Volt)	Rx=(V1/V2) *R (Ω)	Rx=V1/I (Ω)
100					

200					
500					
2k					

Calculations

Plot a graph of V_1 against V_2. Is the graph linear or nonlinear? Determine the slope of the graph and show how can you use the slope to find the value of the unknown resistance R_x.

Discussion

1. For the circuit shown in Fig.1.if the current value (I) is equal to (1.316 mA), $(V_1 = 0.66\,V), (V_3 = 3.95\,V)$, and $(R_{var} = 3k\Omega)$. Determine the value of R_x.
2. You have a voltmeter and ammeter to measure the unknown resistance, suggest the best way to measure the resistance if the value of this resistance:
   a. Very high.
   b. Very low.

   Draw and discuss briefly the circuit diagrams.