Name:

KS16001 LABORATORY 1

LAB 2: RESISTIVE CIRCUITS IN DC

Objective:
To analyze simple resistive circuits in DC: resistors in series, resistors in parallel, series-parallel combination, voltage divider, current divider and the Wheatstone bridge.

Learning Outcomes:
1. The ability to construct simple resistive circuits.
2. The ability to verify the theoretical analysis using resistive circuits experiment.

Instrument/Component:
Power Supply
Multimeter
Resistors-different resistance values (>=1kΩ)

Task 1: Resistors in series.

Assemble the circuit in Figure 2.1, with N=3. Use different resistance values. Take the measurements to complete the entries corresponding to the experimental values in Table 2.1.

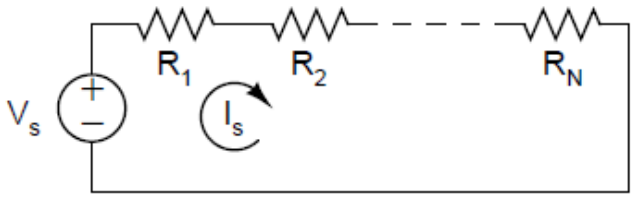

Figure 2.1

Table 2.1

Parameter	R_1	R_2	R_3	R_{eq}	V_s	V_{R1}	V_{R3}	V_{R3}	I_s
Units	kΩ				V				A
Theoretical					10				
Experimental									
%Error					-				

Task 2: Resistors in parallel.

Assemble the circuit in Figure 2.2 with N=3. Use different resistance values. Take measurements to complete the entries corresponding to the experimental values in Table 2.2.

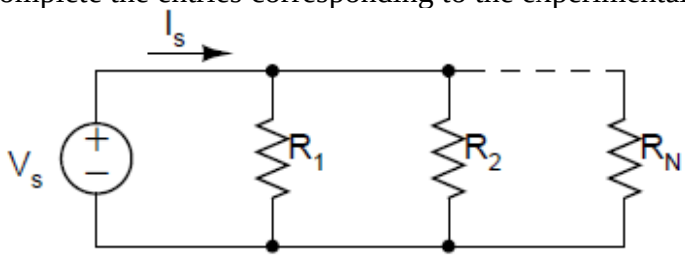

Figure 2.2

Table 2.2

Parameter	R_1	R_2	R_3	R_{eq}	V_s	V_{R1}	V_{R3}	V_{R3}	I_s
Units	kΩ				V				A
Theoretical					10				
Experimental									
%Error					-				

Task 3: Series-parallel combination.

Assemble the circuit in Figure 2.3. Use the resistors in Task 1 and Task 2. Use *Vs*=10 V. Take measurements to complete the entries corresponding to the experimental values. Notice that the resistor experimental values can be taken from the previous measurements in Table 2.1 and Table 2.2. Measure the voltage across each resistor and use Ohm's law and the resistor experimental values to determine the experimental values of *IRi* , *i*=1,2,. . . ,4.

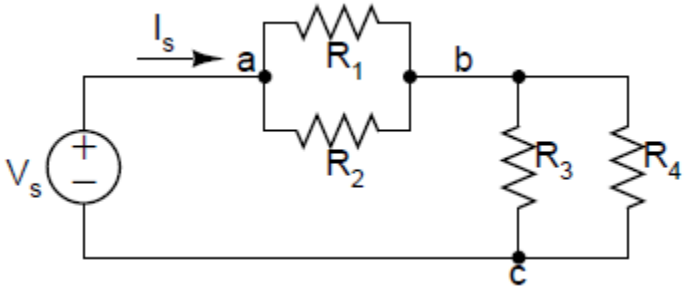

Figure 2.3

Table 2.3

Param	Unit	Theory	Exper	%Error	Param	Unit	Theory	Exper	%Error
R_1	kΩ				I_{R1}	mA			
R_2					I_{R2}				
R_3					I_{R3}				
R_4					I_{R4}				
$R_{a\text{-}c}$					I_s				
V_{ab}	V				V_{bc}	V			

Task 4: Voltage divider.

Assemble the circuit in Figure 2.4. Use different resistance values for R1 and R2. Take measurements to complete the entries corresponding to the experimental values in Table 2.4.

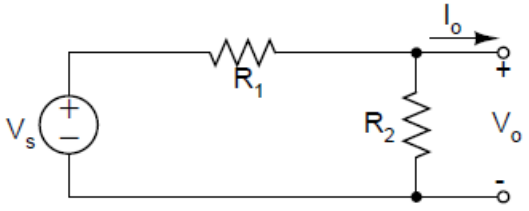

Figure 2.4

Table 2.4

Parameter	R_1	R_2	Vs	Vo
Units	kΩ		V	
Theoretical			10	
Experimental				
%Error				

Task 5: Wheatstone bridge.

Assemble the circuit in Figure 2.5. Use R1=R2=R3 and different value for R4. Take measurements to complete the entries corresponding to the experimental values in Table 2.5.

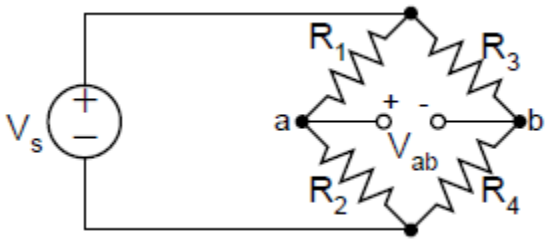

Figure 2.5

Table 2.5

Parameter	R_1	R_2	R_3	R_4	V_s	V_{ab}
Units	kΩ				V	
Theoretical					10	
Experimental						
%Error						

Task 6: Analysis

This section is intended for the analysis and comparison of the experimental and theoretical results. Answer all the questions.

1. Calculate the error percentage between the measured and theoretical data and complete all the corresponding entries in Tables 2.1 through 2.5. The error percentage is given by

$$\%\text{error} = \frac{d_{th} - d_m}{d_{th}} \times 100$$

where d_{th} and d_m are the theoretical and measured data respectively.

2. From the previoud results, comment on the three parameters with the highest error percentages and the three with the lowest error percentages. Discuss the possible causes for error and comment on the overall agreement between the measured and theoretical data.

3. From the results of the series-parallel combination circuit select the true statements:
   (a) $Is = I_{R1} + I_{R2} + I_{R3} + I_{R4}$,
   (b) $V_{ab} = V_s - V_{bc}$,
   (c) $I_s = I_{R1} + I_{R2} = I_{R3} + I_{R4}$.

4. A voltage divider can provide a voltage at its output, but it cannot provide current. If a device is connected to the output of a voltage divider, what value of resistance should it have?

5. In a Wheatstone bridge, assume $R1=2R2$ and $R3=2R4$. What is the value of Vab?