Physics II Lab

Course code : Phy 4242

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Section : 1B

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Experiment No. 1

Name of the Experiment:

familiarization with simple electrical circuits.

Objective:

The purpose of this experiment is to introduce fundamentals of electrical circuits to us, the students. Through this experiment, we will learn to construct circuits and draw circuit diagram. This experiment provides a tutorial to construct circuits, draw circuit diagram and use common measuring equipment.

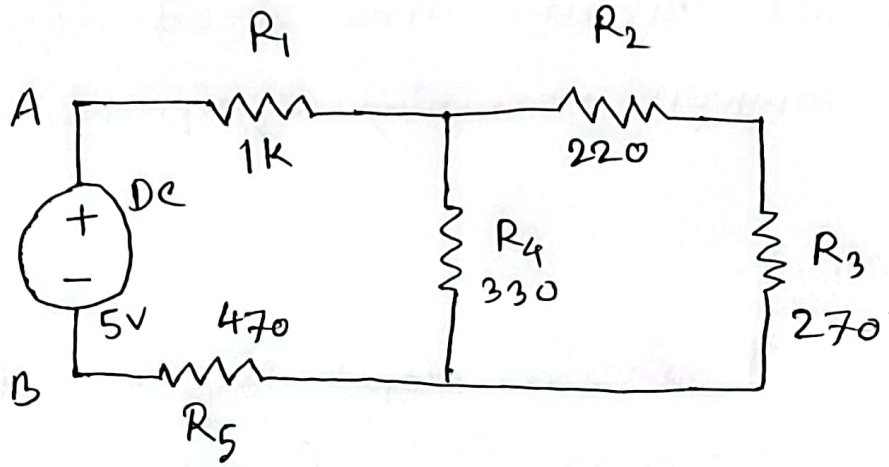
Theory:

A circuit is a closed loop or path through which electrons flow, facilitating the transfer of electrical energy. It comprises interconnected components such as resistors, capacitors, inductors and switches, designed to perform

specific functions like amplification, filtering or switching. Circuits can be analog or digital and are fundamentals to electronic devices, enabling the manipulation and control of electrical signals for various applications in technology, communication and power system.

Laboratory Task

circuit diagram



Here A is the positive terminal and B is the negative terminal of power source. By using multimeter, the functionality of the circuit was verified.

Used Materials:

1. Resistor
2. Multimeter
3. Breadboard
4. Voltage source

Table for Determining Equivalent Resistance:

Resistor Name	Theoritical Resistance (Ω)	Experimental Resistance (Ω)
R_1	1000	995
R_2	220	215
R_3	270	263
R_4	330	325
R_5	470	456

Calculation:

Theoritical equivalent resistance

$$= R_1 + \{(R_2 + R_3)^{-1} + R_4^{-1}\} + R_5$$

$$= 1644.462$$

Experimentally measured equivalent resistance:

To measure the equivalent resistance of the built circuit, we connected one multimeter probe to the 1st resistor and the other probe to the last resistor.

The displayed resistance = 1647 Ω

$$\% \text{ of error} = \frac{|1644.462 - 1647|}{1644.462} \times 100\%$$

$$= 0.152\%$$

Voltage drop and Current calculation

Theoretical

Voltage supplied, $V = 5\,V$

Equivalent resistance, $R_{eq} = 1644.462\,\Omega$

$$\therefore \text{Current}, I = \frac{V}{R_{eq}} = \frac{5}{1644.462} = 3.04 \times 10^{-3}$$

the circuit was verified.

Current through Resistors

For R_1, $I_1 = 3.04 \times 10^{-3} A$

For R_2, $I_2 = 3.04 \times 10^{-3} \times \frac{325}{325+215+263} A = 1.23 \times 10^{-3} A$

For R_3, $I_3 = I_2 = 1.23 \times 10^{-3} A$

For R_4, $I_4 = 3.04 \times 10^{-3} \times \frac{215+263}{215+263+325} = 1.8 \times 10^{-3} A$

For R_5, $I_5 = 3.04 \times 10^{-3}$

Voltage Drop through each Resistors

For R_1, $V_1 = I_1 R_1 = 3.025 V$

For R_2, $V_2 = I_2 R_2 = 0.2644 V$

For R_3, $V_3 = I_3 R_3 = 0.32349 V$

For R_4, $V_4 = I_4 R_4 = 0.588 V$

For R_5, $V_5 = I_5 R_5 = 1.386 V$

Data table:

Resistance	Theoretical		Experimental		Error	
	Voltage (V)	Current (A)	Voltage (V)	Current (A)	Voltage (%)	Current (%)
R_1	3.025	3.04×10^{-3}	3.04	3.05×10^{-3}	0.49	0.33
R_2	026445	1.23×10^{-3}	0.26	1.21×10^{-3}	1.68	1.63
R_3	0.32349	1.23×10^{-3}	0.32	1.22×10^{-3}	1.08	0.81
R_4	0.588	1.8×10^{-3}	0.59	1.81×10^{-3}	0.34	0.55
R_5	1.386	3.04×10^{-3}	1.39	3.05×10^{-3}	0.29	0.33

Discussion:

Due to many ~~environt~~ environmental factors, we had some errors compared to the theoretical value. But, since the error is very little, it shows that our calculation process is accurate.

the circuit was verified.

Question and Answer

(i) The two sides of the DC source are termed as A and B. Here A terminal is the positive one and B is negative. As the circuit is connected with a voltage source, the circuit works.

(ii) The individual and equivalent resistance slightly differs from the theoretical calculation.

(iii) For various environmental factors, such as temperature or, connection loose, the error ~~occ~~ in the result occurs.

(iv) R_1 is in series, R_4 is parallel with R_2, R_3 where R_2, R_3 are in series. R_5 is in series with the ~~rest~~ of the circuit

(v) Multimeter measures resistance by applying its own voltage. So, if we don't disconnect the DC source, the result would different from the actual result.

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Experiment-1

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Tables:

1. a) Eqv. Resistance

Theoretical	Experimental	Error
1644.462	1647	0.15202%

1. b) Voltage

Resistance	Theoretical		Experimental		Error
	Voltage	current	Voltage	current	Voltage
R_1	3.025	3.04×10^{-3}	3.04	3.05×10^{-3}	0.49%
R_2	0.26445	1.23×10^{-3}	0.26	1.21×10^{-3}	1.68%
R_3	0.32349	1.23×10^{-3}	0.32	1.22×10^{-3}	1.08%
R_4	0.588	1.8×10^{-3}	0.59	1.81×10^{-3}	0.34%
R_5	1.386	3.04×10^{-3}	1.39	3.05×10^{-3}	0.29%

05/02/2024.

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