Caden R.
10/24/23
5N-01

Lab Direct Current Circuits

Experiment 1

We are doing this experiment to verify the nominal values of our resistors, and all were in the expected ±5% Ω value upon testing. The laws for in series and in parallel resistors can be seen too.

Experiment 2

We are doing this experiment to verify the laws of resistors in series and in parallel. Our first resistor is measured at 675Ω, and our second resistor is measured at 555Ω. In series, they should measure $675+555=1230\Omega$, and we measure at, 1233Ω. In parallel, they should measure $\frac{1}{\frac{1}{675}+\frac{1}{555}} \approx 305\Omega$, and we measure 305Ω. We then introduce a 816Ω resistor in series with the 675Ω and 555Ω resistors already in parallel, so that the resistance should be $816+\frac{1}{\frac{1}{675}+\frac{1}{555}} = 1121\Omega$, and we measure 1121Ω.

Experiment 3a

We are doing this experiment to verify ohm's law in circuits. After measuring from a to b we verify $V_a - V_b = 0$, which is the readout we expect. After measuring from b to c we find $V_b - V_c = 9.08V$, then V_{cb} will be $-9.08V$. $V_{ab}=0$, $V_{bc}=9.08V$, $V_{cd}=0V$, $V_{da}=-9.08V$. Voltage sum of circuit is $V_{ab}+V_{bc}+V_{cd}+V_{da}=9.08+0+0-9.08=0V$.

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Experiment 3b

Using $I = \frac{V}{R}$, 5V and an 816Ω resistor, $I = \frac{5}{816} = 6.04\text{mA}$. Measuring now from point c to d, we observe -6.04mA. The currents measure the same but cd is negative while ab is positive. Expected voltage was 5V and measured voltage was 5V.

Experiment 4a

We are doing this experiment to observe voltage in a 2 resistor in series circuit, with $R_1 = 816$ and $R_2 = 675$. $V_{bc} = 2.77$, $V_{de} = 2.29$, $V_{fa} = -5.05$, then V_{ab} should be 0V, V_{cd} should be 0V, and V_{ef} should be 0V. We verify all parts/measurements. We now verify $V_{be} = |V_{fa}|$, and measure $5.05\text{V} = |-5.05\text{V}|$ which is true.

Experiment 4b

We are doing this experiment to observe current and verify Ohm's law accordingly. $I_{ab} = 3.32\text{mA}$, $I_{cd} = 3.32\text{mA}$, and $I_{ef} = 3.32\text{mA}$. The current is the same at all points of the circuit. Now, $R_1 = \frac{V_{be}}{I_{bc}} = \frac{2.77}{3.32 \cdot 10^{-3}} = 834\Omega$ and $R_2 = \frac{V_{de}}{I_{de}} = \frac{2.29}{3.32 \cdot 10^{-3}} = 690\Omega$. From our known values of $R_1 = 816\Omega$ and $R_2 = 675\Omega$, the predicted values are within 5% of the actual resistor values. Now, $R_{total} = \frac{V_{be}}{I_{ab}} = \frac{5.05}{3.32 \cdot 10^{-3}} = 1521\Omega$, while using our known $R_1 + R_2$ yields $816 + 675 = 1491\Omega$. They are within 5% of each other.

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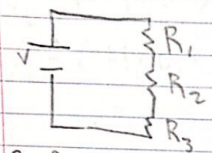
Pre-lab Direct Current Circuits

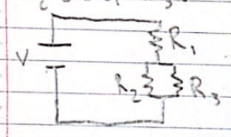
Lab 10/24

1. Draw a two terminal diagram showing a resistor R_1 in series with two other resistors in series, R_2 and R_3.



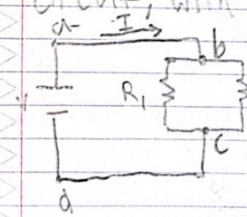
$$R_{total} = R_1 + R_2 + R_3$$

2. Draw a two terminal diagram showing a Resistor, R_1, in series with two other resistors in parallel, R_2 and R_3.



$$R_{total} = R_1 + \frac{1}{\frac{1}{R_2} + \frac{1}{R_3}}$$

3. Say the resistors are connected in the following circuit, with $R_1 = 100\Omega$, $R_2 = 200\Omega$, and $V = 14$ volts



$$I = \frac{V}{\frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}} = \frac{14}{\frac{1}{\frac{1}{100} + \frac{1}{200}}} = 0.21\ A$$

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