**Queensborough Community College**

The City University of New York

**Department of Engineering Technology**

**ET 110 – Introduction to Circuit Analysis Laboratory**

**Lab#6**

*Ohm’s law, series circuits, Kirchhoff’s voltage law (KVL) and the voltage divider rule*

**Inspector: Prof. Wu**

**Date 9/30/16**

**Fall 2016**

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**Objective**

* Learn Ohm’s Law, know the Ohm’s Equations.
* Using a series circuits to measure the current and voltage
* According to the KVL, in the series circuit
* Learn how to use VOD to get voltage across the elements
* Non-Resistive series circuits

**Components’ list**

* Power supply
* 1.5kΩ, 2.2kΩ, 470Ω resistors
* Red Led
* Jumper wires
* Protoboard
* DMM
* Calculator

**Experimental**

* **Part 1: Ohm’s Law**

|  |  |  |  |
| --- | --- | --- | --- |
| **Resistor Value** | **Measured Resistance** | **Measured Voltage** | **Measured Current** |
| 2.2KΩ | 2.16kΩ | 9.04V | 4.23mA |
| Table 6.1- Ohm’s Law | | | |

|  |  |  |
| --- | --- | --- |
| **Measured Voltage** | **Measured Current** | **Calculated Resistor Value** |
| 8.96V | 6.05mA | 1.50kΩ |
| Table 6.2- Computing R from V and I | | |

* **Part 2: Series Circuit**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measured Battery Current** | **Measured Current out of 1.5kΩ Resistor** | **Measured Current Out of 2.2kΩ Resistor** | **Measured Voltage Drop Across 1.5kΩ Resistor** | **Measured Voltage Drop Across 2.2kΩ Resistor** |
| 2.43mA | 2.43mA | 2.43mA | 3.65V | 5.33V |
| Table 6.3 – Voltages & Current in a Series Circuit | | | | |

* **Part 3: Voltage Divider Rule**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Calculated** | **Calculated** | **Measured** | **Measured** | **% of difference** | **% of difference** |
| 3.6V | 5.4V | 3.65V | 5.33V | 1.4% | -1.3% |
| Table 6.4- Confirmation of the Voltage Divider Rule | | | | | |

* **Part 4: Non-Resistivity Series Circuit**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Measure** | **Measure** | **Measure** |  |
| 6.87V | 2.11V | 14.70mA | 14.70mA | 8.98V |
| Does the sum of the LED voltage and resistor voltage equal the applied voltage?  In other words, does KVL Hold? **YES.** | | | | |
| Table 6.5 Voltage & Current Measurements for the LED & KVL Confirmation | | | | |

**Questions**

1. When two or more elements are connected end to end, they are in the series circuit.
2. The value of two resistors in series, we just need to add them both together.
3. KCL in a series circuit is the voltage rises will be equal the voltage drops. In other words, the sum of the voltage in series loops should be 0V.
4. VDR is one way to obtain the voltage drop across the series resistors. More simply, the voltage dropped across one of the resistors in series is the product of the applied voltage and the ratio of the particular resistor divided by the total resistors.

1. Yes. The reason is these two resistors are in series circuit, so they will be shared the voltage source base on the KVL.
2. According to table 6.3, the series circuit will have the same current through each element. The reason is when it is a series circuit, the current will equal the voltage over the total resistors base on the Ohm’s Law.

**Conclusion**

In this lab, we are trying to use the Ohm’s Law, KVL and VOR for solving the voltage drops or current through the series circuit. First of all, Ohm’s Law can lead us to get a current, if we already know the voltage source and total resistors in the series network. Similarly, it is also able to find any unknown value (i.e. voltage, current and resistance), if we know the other two. In addition, the KVL let us identify the voltage drops of each branch in the series loop. In fact, we can use the KVL to calculate the unknown voltage, if we already know others. Likewise, the VOR is another way to find the unknown voltage. The difference between KVL and VOR is KVL do not need to know resistance for the elements, it only uses the voltage source and voltage drops. However, The VOR can get voltage, when you just know the voltage source and the resistance of each branch without any information about the voltage drops across them. As a result, both of VOR and KVL can help us to find unknown voltage drops in a series loop with the kind of values given. In the meantime, I have to remember when we measure the current in the circuit, I have to break the terminal and add a jumper wire before I do it!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!