Lab Report number 1

Resistance and Current Measurement

ENS203 – Electrical Circuits I

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Lab Report number I - Getting on board

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1 Introduction

1.1 Background

Get introduced to the laboratory equipment and learn how to measure resistance, voltage and current safely. Learn how to use breadboard to connect components together in series, parallel and mixed configurations. Learn how to use a multimeter to measure resistance, voltage and current.

1.2 Objective

- Switch in DC power supply, and fix it to 5 V, then measure the 5 V using the multi-meter
- When done switch off.
- Switch on function generator, and fix it to produce sin wave with 100 Hz, show the signal on a oscilloscope
- Switch off
- Pick up two unknown resistors, measure them using the multi – meter
- Connect them on bread board in series
- Connect them on the bread board in parallel
- Use more resistors and connect the following circuit on the bread board.

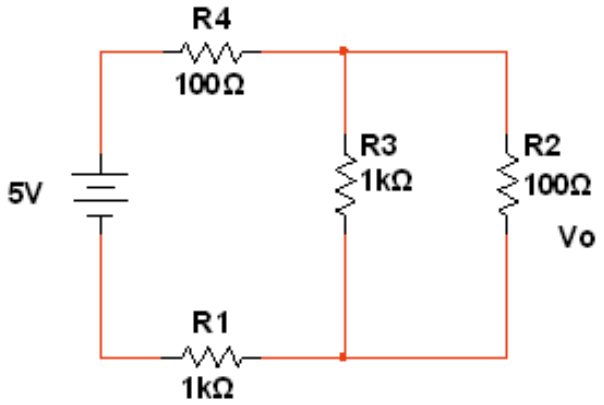
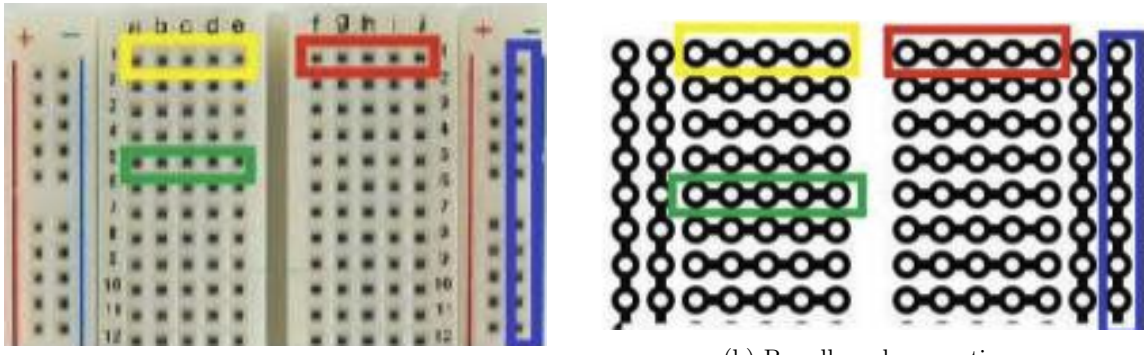


Figure 1: Circuit to be connected on the bread board

2 Methods

2.1 Apparatus

Breadboard also known as protoboard is a type of solderless electronic circuit board, where you can build electronic circuits without any soldering. Its advantages that it is reusable and the circuits are easy to modify and rebuild. Figure 2 shows a part of a breadboard and how the pins are connected, although there are many types of breadboards, the principle is the same.



(a) Physical breadboard

(b) Breadboard connections

Figure 2: Breadboard and its connections

Every 5 holes in horizontal direction, which are marked with letters a,b,c,d,e or f,g,h,I,j represent a one connection point. When we want to connect circuit elements we connect one terminal of each element in one of the 5 holes, and we connect another element's terminal into another hole of the 5 to have two elements connected at one point.

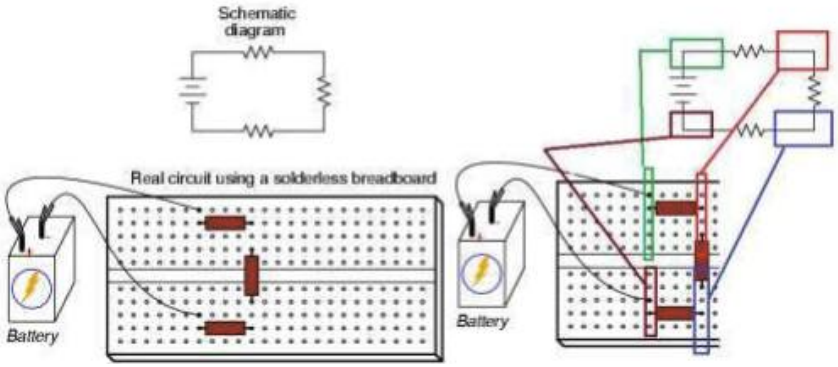


Figure 3: Scheme diagram on a breadboard

Multi-meter used to measure electrical quantities

Figure 4: Multi-meters

DC power supply used to provide a constant voltage

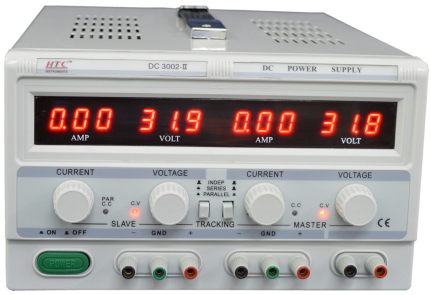


Figure 5: DC power supply

Function generator used to produce a signal

Figure 6: Function generator

Oscilloscope used to show an signal

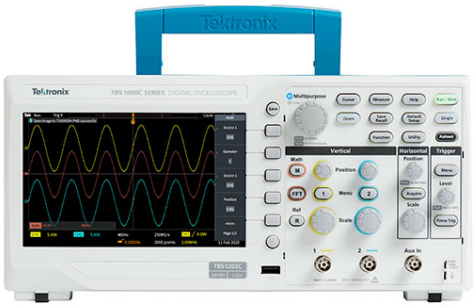


Figure 7: Oscilloscope

Probes used to measure voltage

Figure 8: Probes

Resistors are used to control the current flow in circuits, they are mainly made of compost materials and their values which are given in Ohms can be found from color code (bands) on the resistor or by measuring the value of the resistance using Ohm-meter. Resistors and color code are shown in Figure 9.

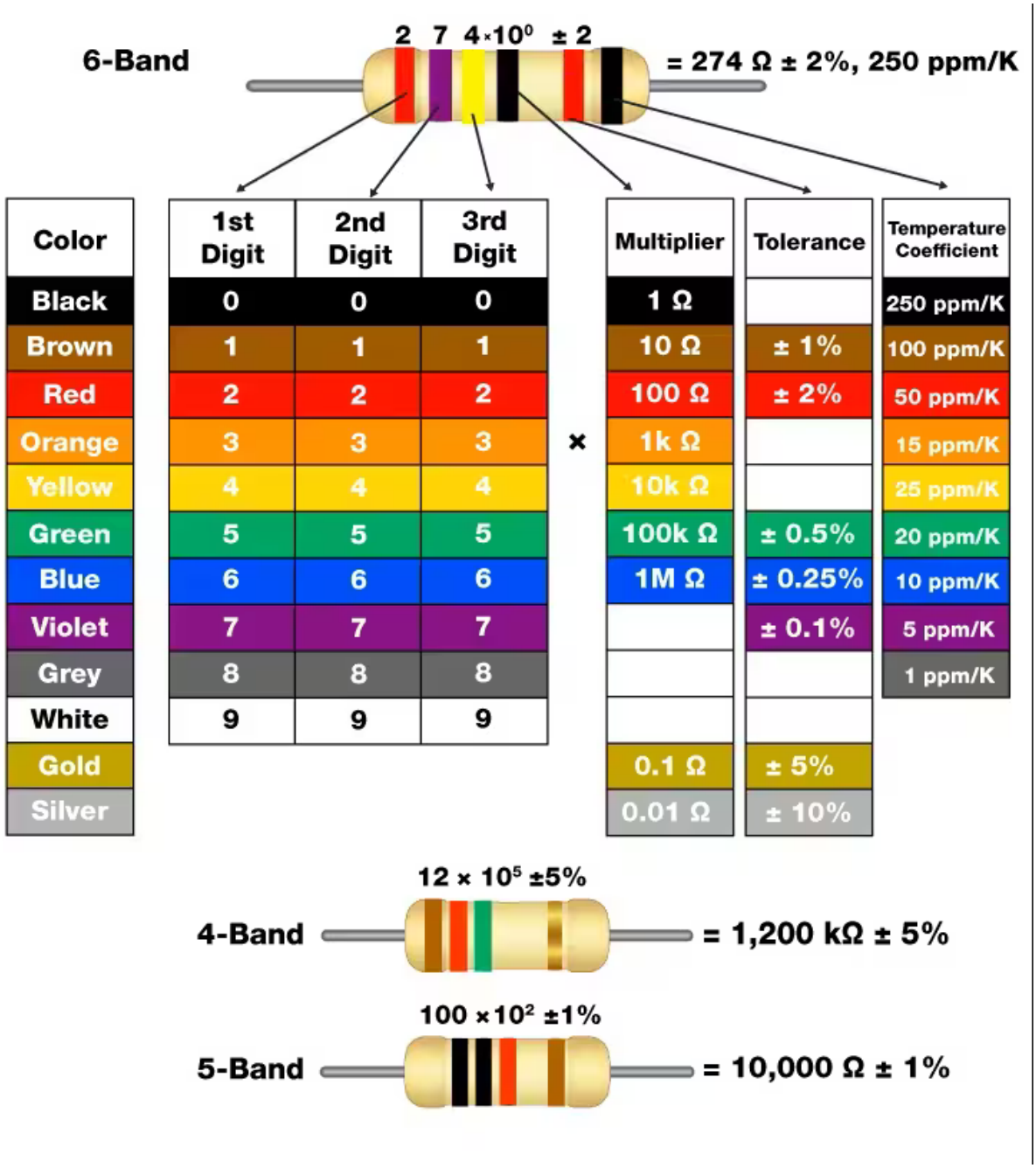


Figure 9: Resistor color code table

2.2 Procedure

To achive all of our goals we need to follow the following steps:

1. Switch in DC power supply, and fix it to 5 V, then measure the 5 V using the multi-meter
2. When done switch off.
3. Switch on the function generator, and fix it to produce sin wave with 100 Hz
4. Measure and show the signal via a oscilloscope
5. Switch them both off
6. Pick up two unknown resistors, measure them using the multi–meter
7. Connect them on bread board in series
8. Connect them on the bread board in parallel
9. Use more resistors and connect the circuit as shown in Figure 1

2.2.1 Turning on the DC power supply

Here is a list of steps followed to turn on the DC power supply safely in the laboratory:

1. Connect the power supply to the power source
2. Call an assistant to check the connections
3. Turn on the power supply with the assistans approval
4. Set the voltage to 5V
5. Turn off the power supply

Before measuring the voltage with the multi-meter, we decided to take some resisotrs and make a simple circuit of 3 resistors in a series connection and measure the voltage across the entire circuit and the voltage across each resistor.

2.2.2 Constructing the series circuit

We took 3 identical resistors, which were labaled to be 2200Ω with some tolerance, and to be sure we measured them using a multimeter as can be seen at Figure 10.

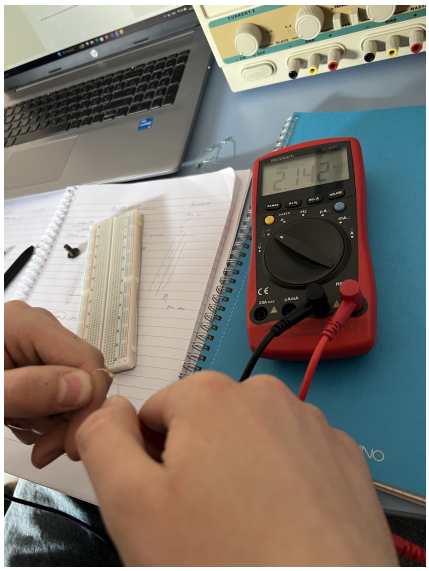
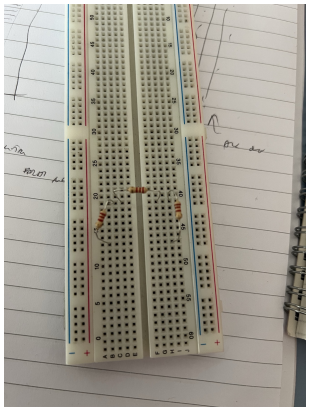


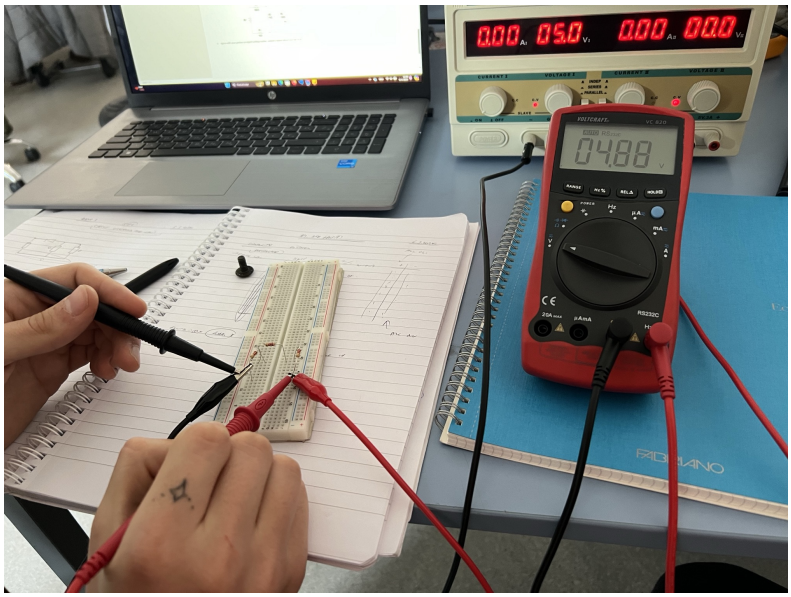
Figure 10: Measuring unknown resistors

After setting up the multimeter to measure resistance, and after making sure the probes were connected properly to the multimeter, we measured the resistance of the first resistor to be 2.142kΩ = 2142Ω. As we can see the tolerance of the resistor is ±5% (as shown by the golden ring).

Now we connected the resistors in series, and measured the voltage across the entire circuit and the voltage across each resistor.



(a) Simple Circuit in series



(b) Multimeter measuring voltage over a simple circuit of 3 resistors in series

Figure 11: Measuring voltage of a simple circuit

As we can see the voltage across the entire circuit is 4.8V, and the voltage of the power supply is set to be 5.0V. The reason for this difference, as stated by the lab assistatns, is that the power supply is not perfect and it has some internal resistance, which causes the voltage to drop when a load is connected to

it, and the probes used for the multimeter also have some resistance, which causes the voltage to drop when the multimeter is connected to the circuit. Another reason for the voltage drop is the inaccuracy of the multimeter, which is not perfect and has some tolerance same with the DC power supply. With this we conclude tasks with the DC power supply, parallel and series connection of resistors, and measuring the voltage across the entire circuit. One small note is that unfortunately we did not save our images of the parallel connection of resistors but you will be able to see a mixed connection when we get to the last task of the lab report.

2.2.3 Using and measuring the function generator

We turned on the function generator and set it to produce a sin wave with 100 Hz, and we connected the output of the function generator to the oscilloscope, and we measured the signal as shown in Figure 12.

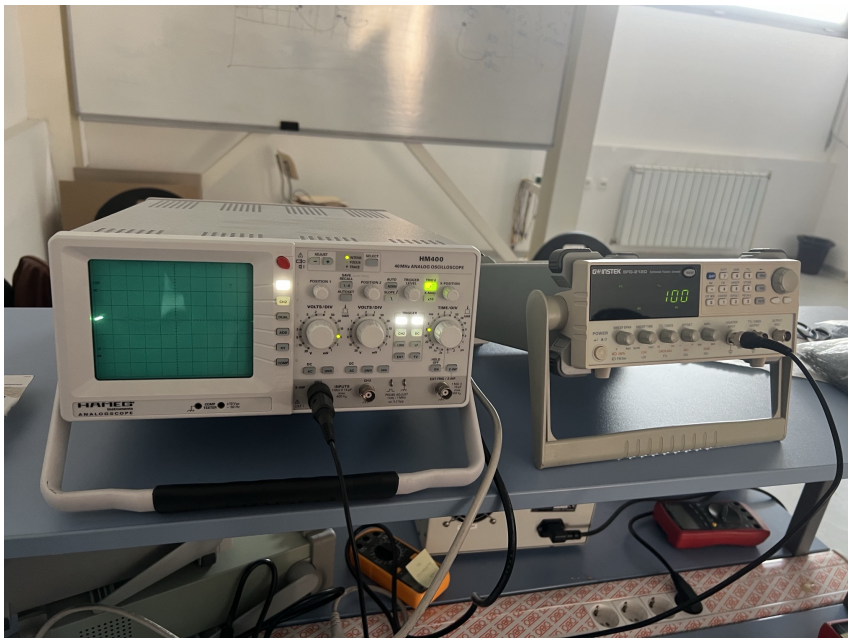


Figure 12: Measuring signal with oscilloscope

This part was very brief since we did not need to set up manually the volts/div and time/div, since the oscilloscope was already set up to measure the signal from the function generator. However in the future we were told that we would cover this in much more detail.