

# Principle of Physics

## Lab 5: Laboratory Measuring Instruments





# Contents

- Topic#1 : Using Digital Multi-meter (DMM).
- Topic#2 : Calculating the Value of The Resistor with Coloring Code Method.
- Topic#3 : Building Circuits Using The Proto-board/ Breadboard



# Objectives

- To become familiar with the use of a multimeter and the correct procedure to do so.
- To learn how the DC supplies are used.
- To learn to identify resistors and read their color codes.
- To learn how to build a circuit using a protoboard (breadboard).



# Theory

**1. DC Power Supply:** DC power supplies are capable of supplying up to 30V at 500 mA, and can be run in constant current or constant voltage modes.

- In practice there is a wide variety of supplies available in varying specifications for different applications.
- The power supplies typically have a coarse and fine adjustment knob used to select the desired voltage or current. Most supplies have a voltmeter/ammeter built in, but it is often best to confirm the value with a multimeter for increased accuracy.
- We will always use the Red "+" positive and Black "-" negative ports on the supplies.



# Theory

2. **Multimeter:** Multimeters are used to measure current, voltage, resistance, capacitance, and to test for continuity.

- **Digital MultiMeters** have a series of color coded ports towards the bottom, and matching color coded probes. Labels indicate which probes should be attached to which ports depending on which parameters are to be tested.
- Most meters will beep to indicate that the probes should be adjusted when switching between voltage and current measurement.
- **Failure to ensure proper setup may result in damage to the meter.**

# Theory

3. **Resistor:** Resistors are among the simplest electronic components and serve to resist the flow of current.

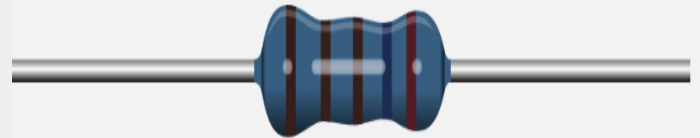
- The flow of current through the restriction in the resistor causes them to heat, and careless construction without consideration of the power to be dissipated in the resistor may cause them to overheat and burn.



# Theory

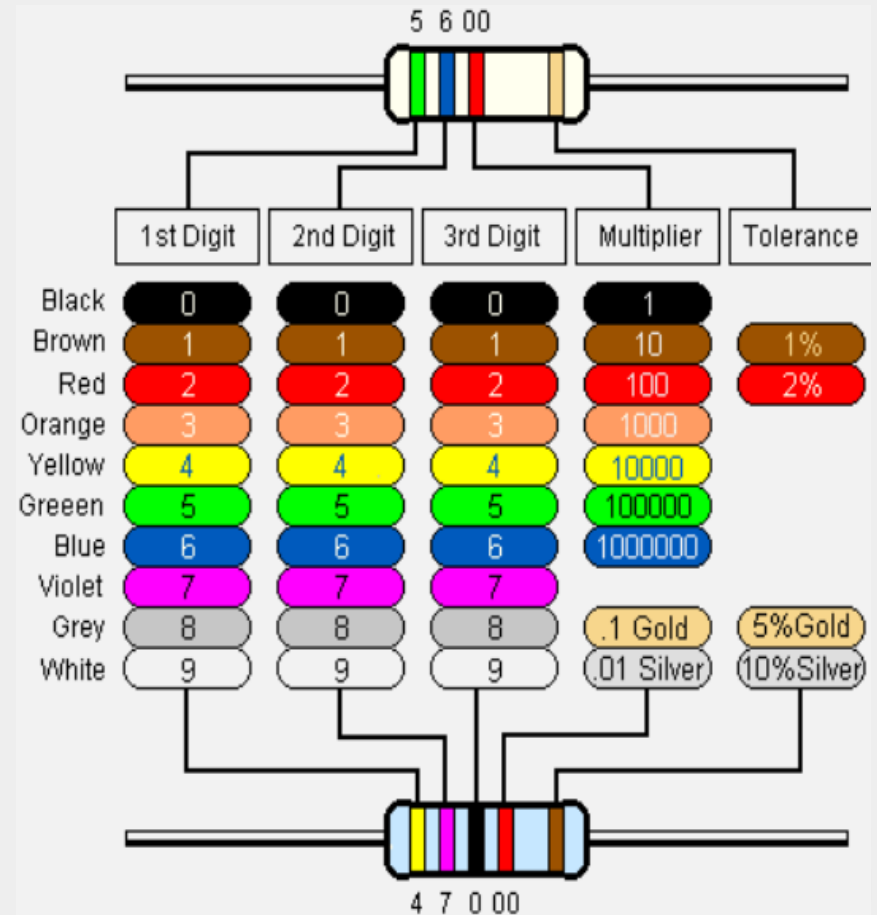
4. **Resistor color coding:** The value of the resistor is indicated by a series of colored bands that run across the part.

- Resistors from various manufacturers may come in different sizes, package colors, have different numbers of bands, and vary in construction principle.
- The colors are often difficult to tell apart on a blue background, so pay special attention to red/orange and green/blue bands.



# Theory

4. **Resistor color coding:** The resistor coding scheme shown here describes how to identify resistors by the colored bands that run across each part.

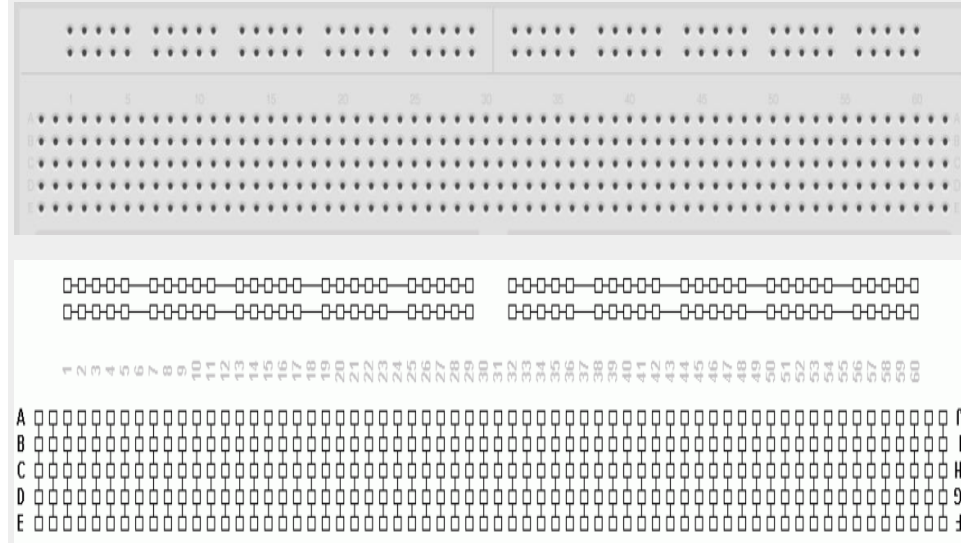




# Theory

5. **Protoboard:** Protoboards, also known as breadboards, are a convenient way to construct non-permanent circuits quickly without tools.

- They feature a grid of tiny holes which are designed to fit resistor and other electronic component leads. The internal connection structure is shown



# Equipment / Tools

- Digital Multimeter.
- DC Power Supply.
- Wires / Jumpers.
- Set of resistors with different values.
- Protoboard / breadboard.



# Procedures

## Testing Resistances

- For each resistor:
  - Record the color code indicated resistance and specified tolerance.
  - Record the actual value measured by multimeter.

## Circuit Construction

- Create circuit 1.1 using your protoboard and the resistors. (**if you have trouble, use this link**)

<https://sites.google.com/view/apsclabs/home/fall/circuits/1/hint1?authuser=0>



# Results

- Create a spreadsheet or table with your lab data and the data obtained from the calculations in the results section.
- Compare the individually measured values and rated tolerance, do the measured values of the resistors fall within the rated tolerance ?



## Oral Question

- Why do the measured values of resistance typically not exactly match the resistance indicated by the color code?

