Experiment 1

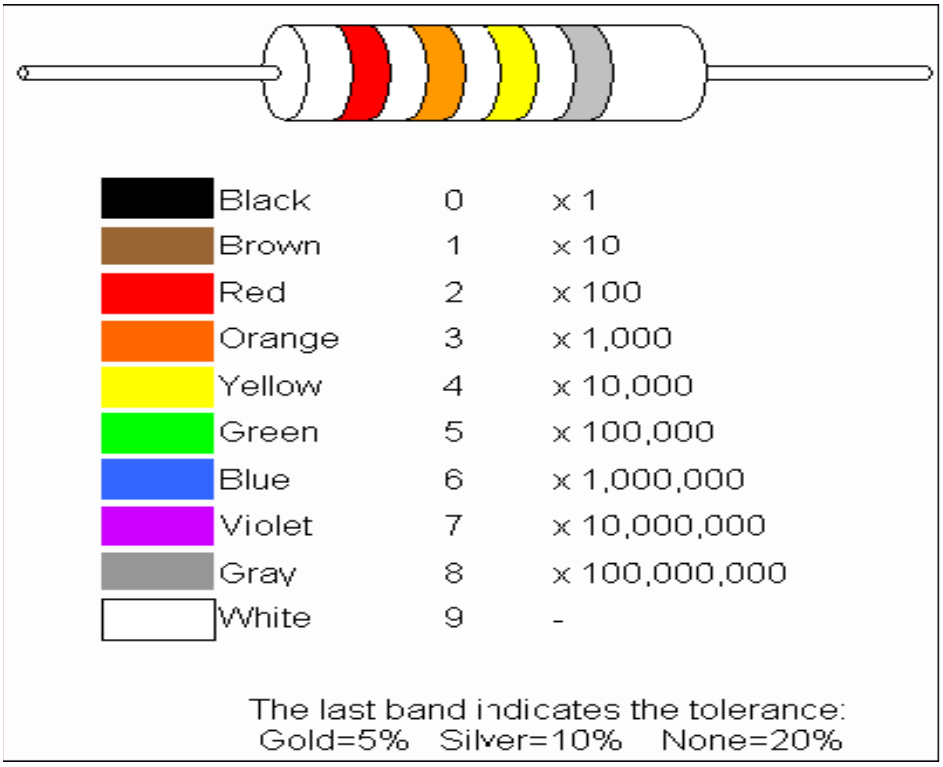
Introduction to the Circuits and Electronics Lab

Objectives:

In this experiment you will learn the following:

- The basic safety rules in the lab.
- What tools to bring with you to the lab.
- The different types of components used in the lab.
- How to read the coded values on resistors, capacitors, and inductors.

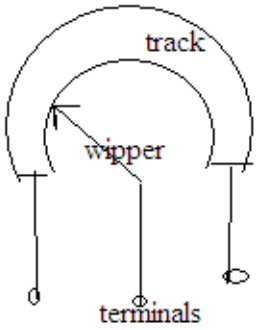
- **Never plug the power connector in the socket before the instrument: doing so may cause electrocution!**
- **The Code of Resistors:**



- **How do I read the resistor value?**

First find the tolerance band, it will typically be gold (5% tolerance) or silver (10% tolerance). Starting from the other end, identify the first band - write down the number associated with that color. Read the next color and write down the number associated with the second color. Now read the third or 'multiplier' band and write down that number of zeros.

Resistors don't need to have fixed values because variable resistors come in different packages and values. Some are linear in motion and others are circular.



***Potentiometer*: variable resistor with 3 terminals connected, used to vary voltage (control the volume, loudness)**

***Multitum*: are used where very precise adjustments must be made (more accuracy and tolerance). The screw must be turned many times (10+) to move the slider from one end of the track to the other, giving fine control.**

- **Types of Capacitors:**

Ceramic capacitors: don't have polarity and have a three digit number written on them. Similar to resistor codes, the first two digits represent the value, and the third is the number of zeros. The unit in this case is picofarads (1 Farad = 10^{12} picofarads.)

Electrolytic capacitors: **are polarized and have an arrow on the side indicating the negative pin. Failing to recognize the proper polarity while connecting the circuit will cause the capacitor to blow up! The value of capacitance along with the unit is printed on the case of the capacitor.**

- ## Inductors:

Inductors are supplied in packages similar to those the same color code of the resistors except for inductors is microhenry (1 Henry = 10^6 microhenrys.) made out of a coil (a piece of rolled up wire.)

- ## Diodes:

There are three main types of diodes which we will use in this lab: The rectifier diode, the zener diode, and the light-emitting diode. Diodes are two terminal devices with a positive terminal and a negative terminal. Current flows from positive to negative. The negative terminal is indicated by a band printed on the case of the diode.

- ## Bipolar Transistors and MOSFETS:

Bipolar transistors and MOSFETS are important components that are used in building analog and digital circuits.

- ## Switches and Push Buttons:

A switch or a push button is a device that makes a circuit connection or disconnects one depending on its type. They are characterized by whether they are normally closed (NC) or normally open (NO), and by the number of throws and number of poles.

- ## Integrated Circuits:

An integrated circuit (IC), sometimes called a chip or microchip, is a semiconductor wafer on which tens to hundreds of millions of tiny resistors, capacitors, and transistors are fabricated. An IC can function as an amplifier, oscillator, timer, counter, computer memory, or microprocessor. A particular IC is categorized as

either linear (analog) or digital, depending on its intended application. These chips can be packaged in cases with different number of pins depending on the application.

- **Relays:**

A mechanical relay is a switch that is activated by an electromagnet. Once current flows in the coil, the resulting magnetic field will attract a metallic plate, causing the switch to change state.

There are two types of relays:

Mechanical Relays:

The main disadvantage of mechanical relays is that they can't operate at high switching frequencies due to mechanical limitations.

Solid-state Relays:

Electronic devices that are easy to connect as a mechanical relay, and can operate at relatively high frequencies. Their drawback is that they don't have as many poles as other types of relays.