

# **EXPERIMENT #1**

## **INTRODUCTION TO ELECTRICAL INSTRUMENTS**

### **OBJECTIVE:**

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### **EQUIPEMENT USED:**

Following are the equipment which we are going to study about.

- Oscilloscope
- Function generator
- DC Power Supply
- Digital Multi-meter (DMM)
- Resistors
- Galvanometer
- Ammeter
- Voltmeter
- Wattmeter
- Wheatstone bridge

### **OSCILLOSCOPE**

Oscilloscope (Also known as Cathode Ray Oscilloscope) is an electronic instrument used for voltage sensing and visualizing constantly varying signal voltages. It can be analogue and digital as well. The output displayed by the oscilloscope is 2- dimensional i-e the variation of voltage waveform with respect to time. The waveform displayed on oscilloscope shows the following parameter.

- Amplitude and distortion of signal
- AC/DC voltages
- Frequency
- Time Period
- Phase shift



## **FUNCTION GENERATOR**

Function generator is equipment used to generate different types of waveform over a wide range of frequencies. Most common waveforms produced by the function generator are sine, square and triangular shapes. Function generators are used in development, test and repair of electronic equipment. For example they may be used as a signal source to test amplifiers or to introduce an error signal in control loop.



## **DC POWER SUPPLY:**

A DC power supply is an electronic device which provides voltage of fixed polarity (either positive or negative) to its load. Some power supplies are discrete, stand-alone devices while others are built into larger devices along with their loads such as desktop computers and consumer electronics.

Every power supply must obtain the energy it supplies to its load, as well as any energy it consumes while performing the task, from an energy source. Depending on the design it obtains energy from batteries, cells, generators, solar power convertors or another power supply.

All power supplies have power input, to obtain energy from energy source and power output that delivers energy to its load.



## **DIGITAL MULTI-METER (DMM):**

Digital multi-meter is a measuring instrument that combines several measuring function in one unit. A typical multi-meter can measure current, voltage and resistance. It has a numeric display to represent the measured value. It is also used to check the continuity between two points to check if there is any break in the circuit. There are two styles of multi-meter.

- Switched
- Auto ranged

### **Switched:**

In switched multi-meter we manually switch between ranges to get most accurate reading.

### **Auto-ranged:**

In auto ranged multi-meter there is an automatic switching between the ranges to get best reading.



### **RESISTOR:**

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors reduce the current flow as well as lowers down the voltage level. High power resistors that can dissipate many watts of power as heat may be used as part of motor control, in power distribution system or as test loads for generators. Fixed resistors have resistance that can slightly change with the temperature, time or operating voltage. Variable resistors can be used to adjust the circuit elements or as sensing device for heat, light, humidity etc.



## **GALVANOMETER:**

Galvanometer is a sensitive device used for detection of small amount of current. It is an analogue electromechanical actuator that produces the rotator deflection of some type of pointer in response to electric current through its coil in a magnetic field. Depending upon the nature galvanometer can be divided into two types;

- Moving coil galvanometer
- Moving magnet galvanometer.



## **AMMETER:**

Ammeter is a measuring instrument used to measure current in a circuit. Electric current is measured in amperes; hence the name is based on its unit. Ammeters are of different types like moving-coil, moving magnet, moving iron etc. but the most frequently and latest used are digital ammeter. Digital ammeter designs use a shunt resistor to produce a calibrated voltage proportional to current flowing. The digital display is calibrated to display the current through the shunt. Ammeters are connected in series with the circuit to measure its current. Ammeters are designed for low voltage drop across their terminal. The extra losses produced by ammeter are called its “burden”.



## **VOLTMETER:**

A voltmeter is an instrument used to measure the potential difference between two points in a circuit. Analog voltmeters move a pointer across a scale in proportion to the voltage of the circuit. Digital voltmeters display the numerical value on the screen by use of analog to digital converter. Digital voltmeter designs consist of a high resistor connected in series. Voltmeters are connected in parallel to measure the voltage across the circuit or component.



## **WATTMETER:**

The wattmeter is an instrument for measuring the electric power (or the supply rate of electrical energy) in watts of any given circuit. The internal construction of a wattmeter is such that it consists of two coils. One of the coils is in series and the other is connected in parallel. The coil that is connected in series with the circuit is known as the current coil and the one that is connected in parallel with the circuit is known as the voltage coil.



## **WHEATSTONE BRIDGE:**

Wheatstone bridge is an electrical circuit used to measure an unknown resistance by balancing two legs of bridge circuit one leg which includes the unknown component. The primary benefit of Wheatstone bridge is that it provides the extremely accurate measurements. Its operation is similar to the original potentiometer.



**OBSERVATION & CALCULATIONS:**

- *Measure the resistance of each of the 3 resistors in the resistor box and record the measured resistance values along with the color code for each.*
- *Switch the function generator to 10 Hz, then to 1 Hz, then to 0.2 Hz, leaving the output level fixed on oscilloscope. Write down your observation.*
- *Write down your observation about Ammeter, Voltmeter and Galvanometer.*

**CONCLUSION:**

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**OBSERVATION & CALCULATIONS:**

	<u>Resistor 1</u>	<u>Resistor 2</u>	<u>Resistor 3</u>
<u>DMM</u>			
<u>COLOR CODING</u>			