

GANPAT UNIVERSITY

U. V. PATEL COLLEGE OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

SUBJECT: 2ES103 BASIC ELECTRICAL
ENGINEERING (BEE)

**BASIC ELECTRICAL
ENGINEERING
LABORATORY**



Welcome to the ELECTRICAL ENGINEERING DEPARTMENT – BASIC ELECTRICAL ENGINEERING LABORATORY



What you know about “Basics of Electrical Engineering”???

Electricity ?

Current ?

Circuits ?

Electric Shock ?

Electrons ?

Voltage ?

Wires ?

Toooo many questions ?

Experiment 1

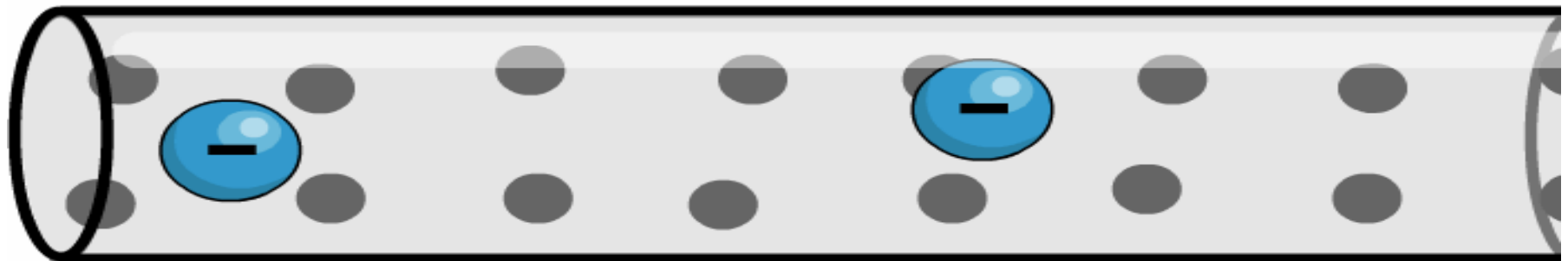
AIM: Introduction to Basic Electrical Engineering Laboratory

Let's have an introduction to basic terminologies used in electrical engineering...

- 1) **CURRENT (I)**: Electric current is defined as the rate of flow of negative charges of the conductor
OR the continuous flow of electrons in an electric circuit is called an electric current.

Its unit is AMPERE (A)

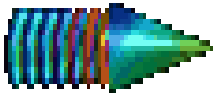
- 2) **AMPERE (A)** — A unit of measure for the intensity of an electric current flowing in a circuit. One ampere is equal to a current flow of one coulomb per second.



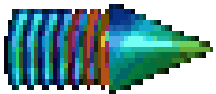
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Understanding Current

This flow of electrical charge is referred to as electric current. There are two types of current



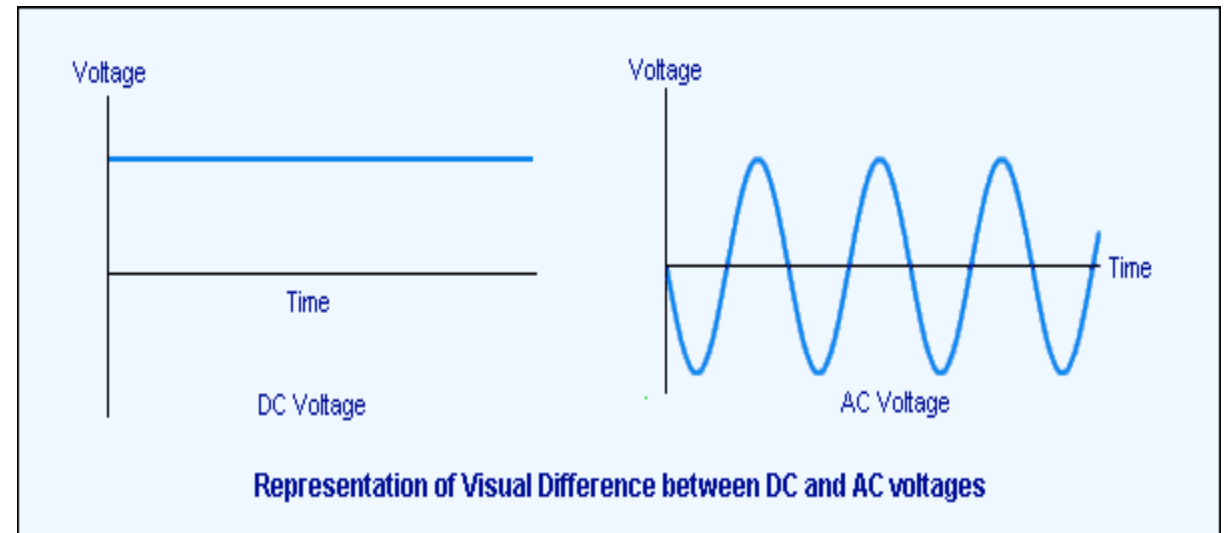
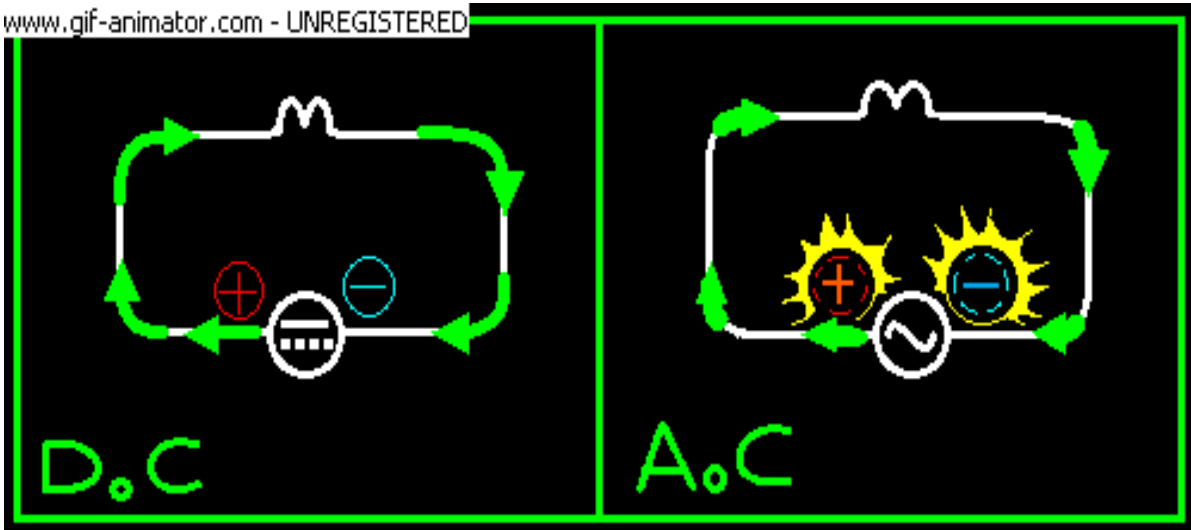
DIRECT CURRENT



ALTERNATE CURRENT

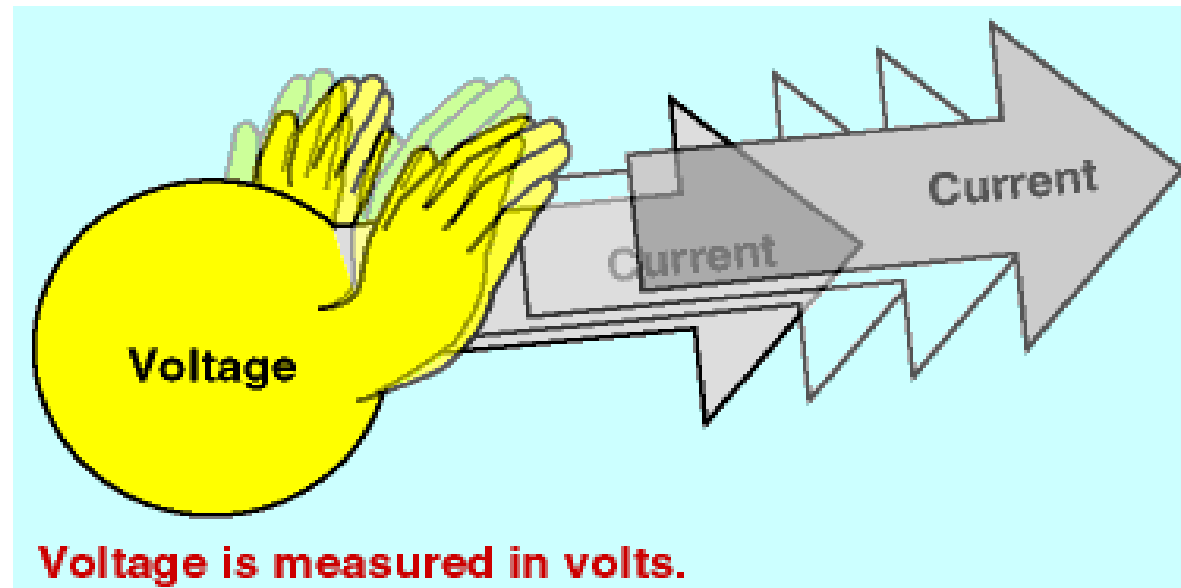
DC is current that flows in one direction with a constant voltage polarity while AC is current that changes direction periodically along with its voltage polarity.

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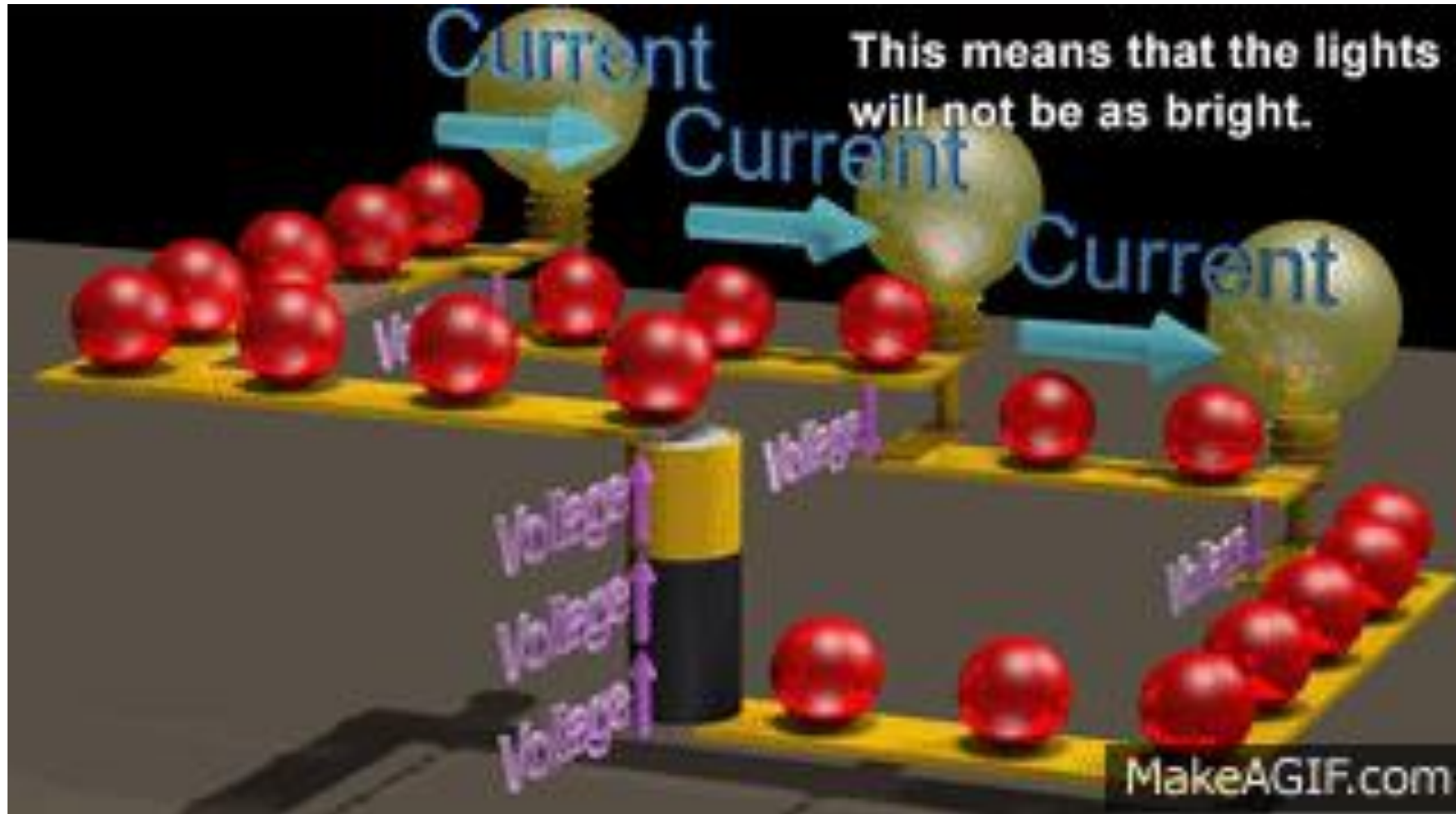


3) **VOLTAGE (POTENTIAL) – (V)**: An electromotive force or "pressure" that causes electrons to flow and can be compared to water pressure which causes water to flow in a pipe. Measured in volts. Its unit is VOLT (V)

4) **VOLT (V)**: A unit measure of voltage. One volt is equal to the difference of potential that would drive one ampere of current against one ohm resistance.

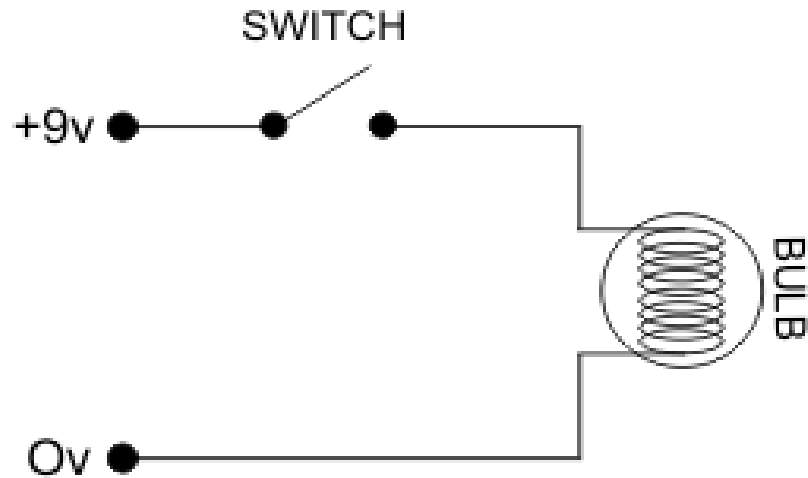


5) ELECTROMOTIVE FORCE — (EMF) A difference in potential that tends to give rise to an electric current. Measured in volts.

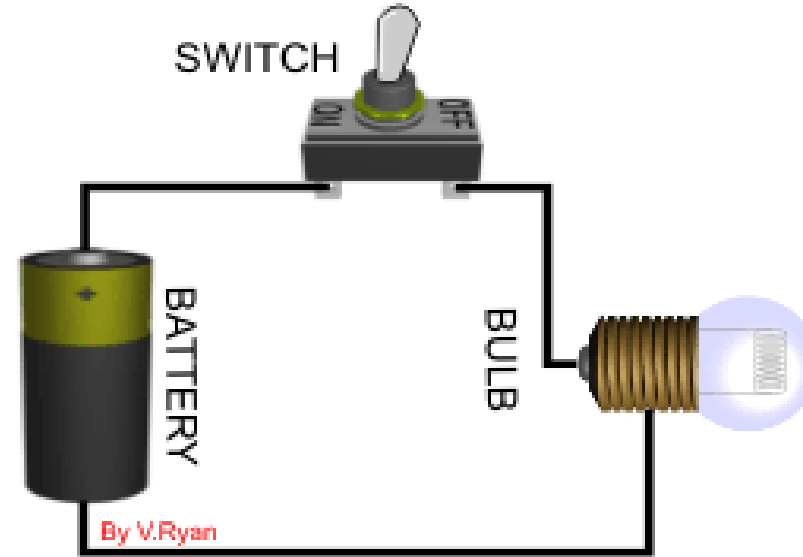


6) **ELECTRICAL CIRCUIT:** A closed path in which electrons from a voltage or current source flow.

CIRCUIT DIAGRAM



PICTORIAL CIRCUIT DIAGRAM

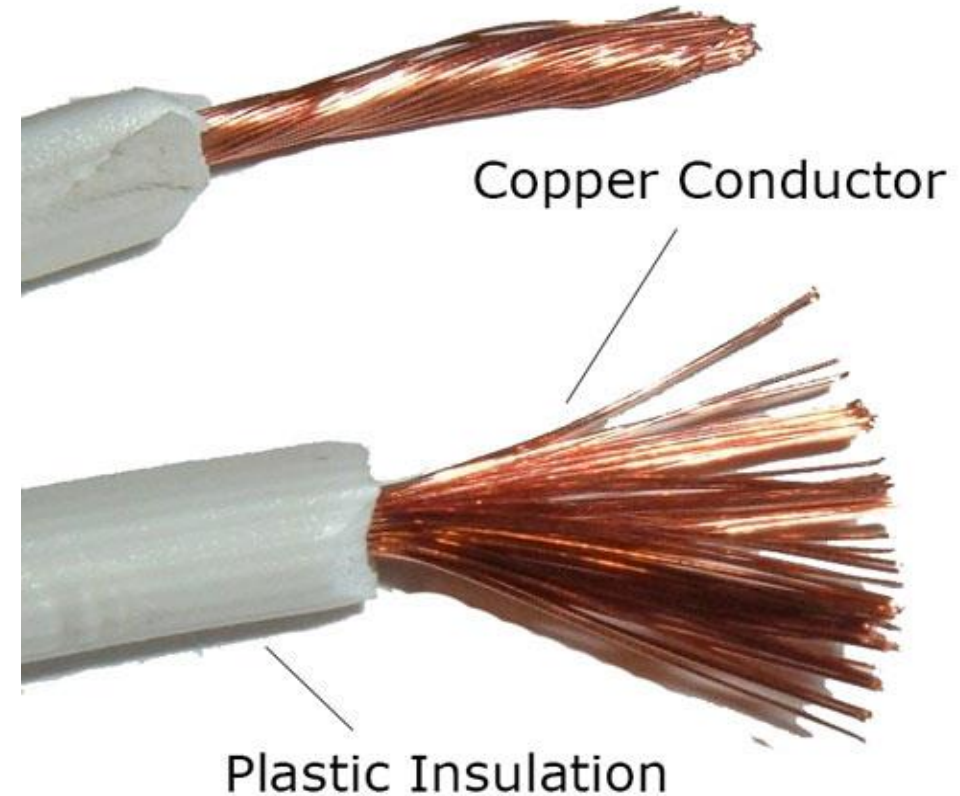
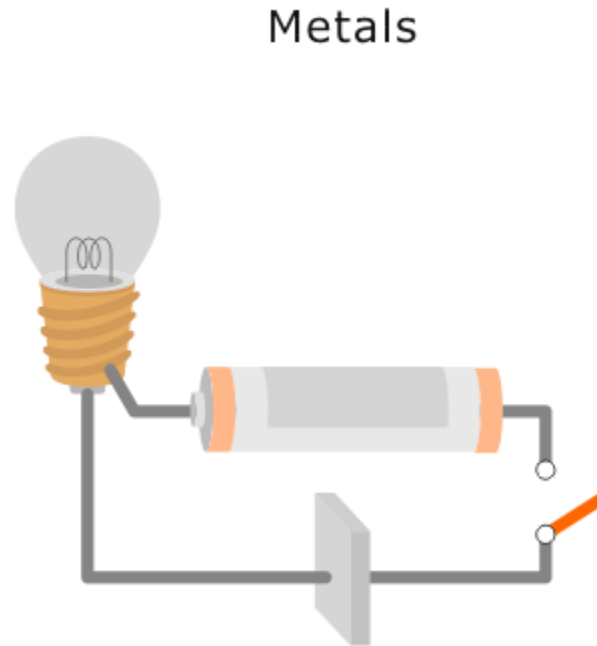
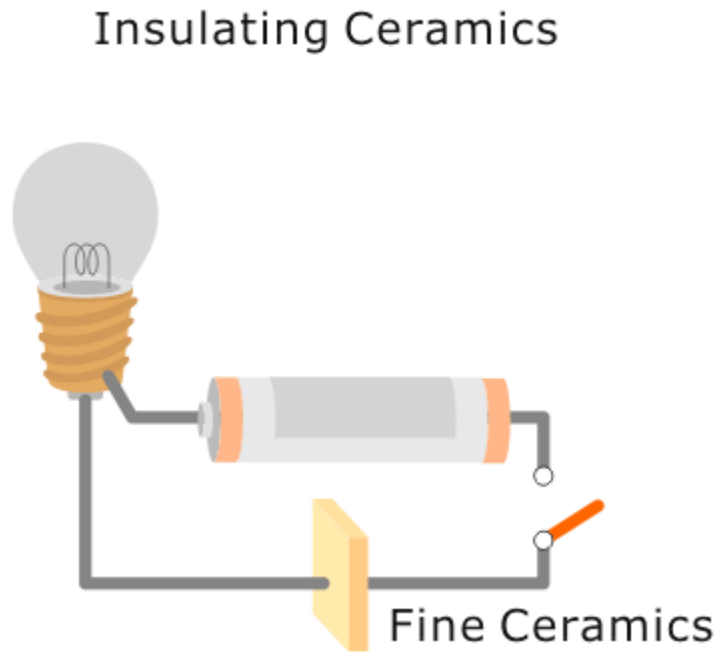


7) **CIRCUIT DIAGRAM:** It is a graphical representation of an electrical circuit.

A pictorial circuit diagram uses simple images of components, while a schematic diagram shows the components and interconnections of the circuit using standardized symbolic representations.

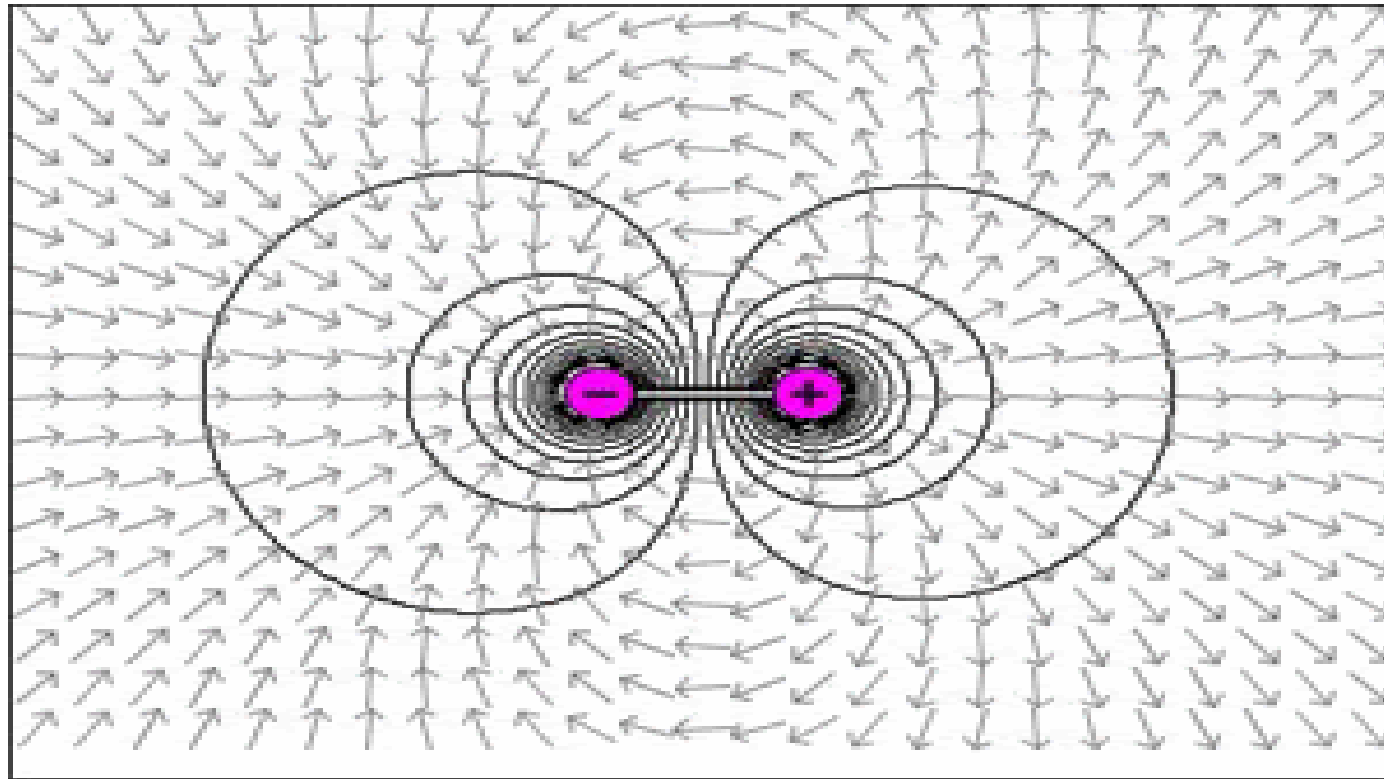
8) CONDUCTOR: Any material where electric current can flow freely. Conductive materials, such as metals like Copper.

9) INSULATOR: Any material where electric current cannot flow freely. Insulative materials, such as glass, rubber, air, and many plastics

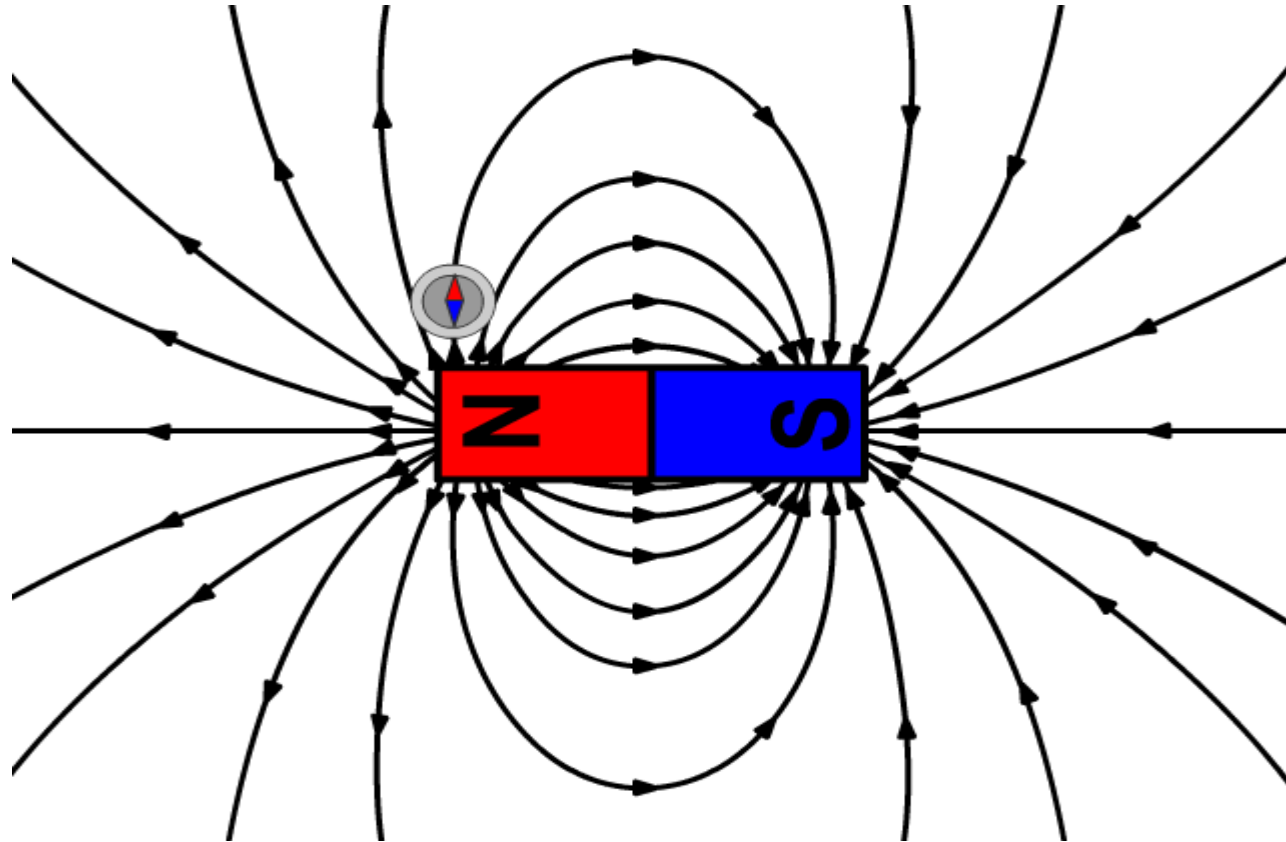


- 10) **POWER** — The rate at which electrical energy is transferred by an electric circuit.
Measured in Watts.
- 11) **WATT (W)** — A unit of electrical power. One watt is equivalent to one joule per second, corresponding to the power in an electric circuit in which the potential difference is one volt and the current one ampere.
- 12) **LOAD** — Anything which consumes electrical energy, such as lights, transformers, heaters and electric motors.
- 13) **ELECTRICAL SOURCE or SUPPLY**: An electrical supply or simply, “a source”, is a device that supplies electrical power to a circuit in the form of a voltage source or a current source.

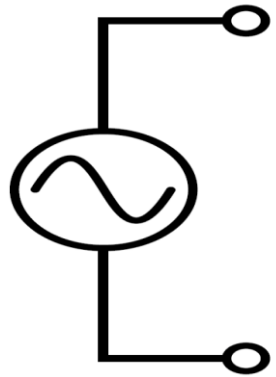
14) ELECTRIC FIELD — An electric field is the physical field that surrounds each electric charge and exerts force on all other charges in the field, either attracting or repelling them.



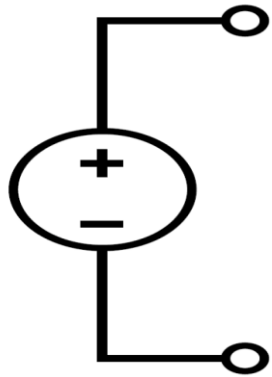
15) MAGNETIC FIELD — A **magnetic field** is a vector **field** that describes the **magnetic** influence on moving electric charges, electric currents, and magnetized materials. A charge that is moving in a **magnetic field** experiences a force perpendicular to its own velocity and to the **magnetic field**.



❖ **VOLTAGE SOURCE**: A voltage source, such as a battery or generator, provides a potential difference (voltage) between two points within an electrical circuit allowing current to flow around it.

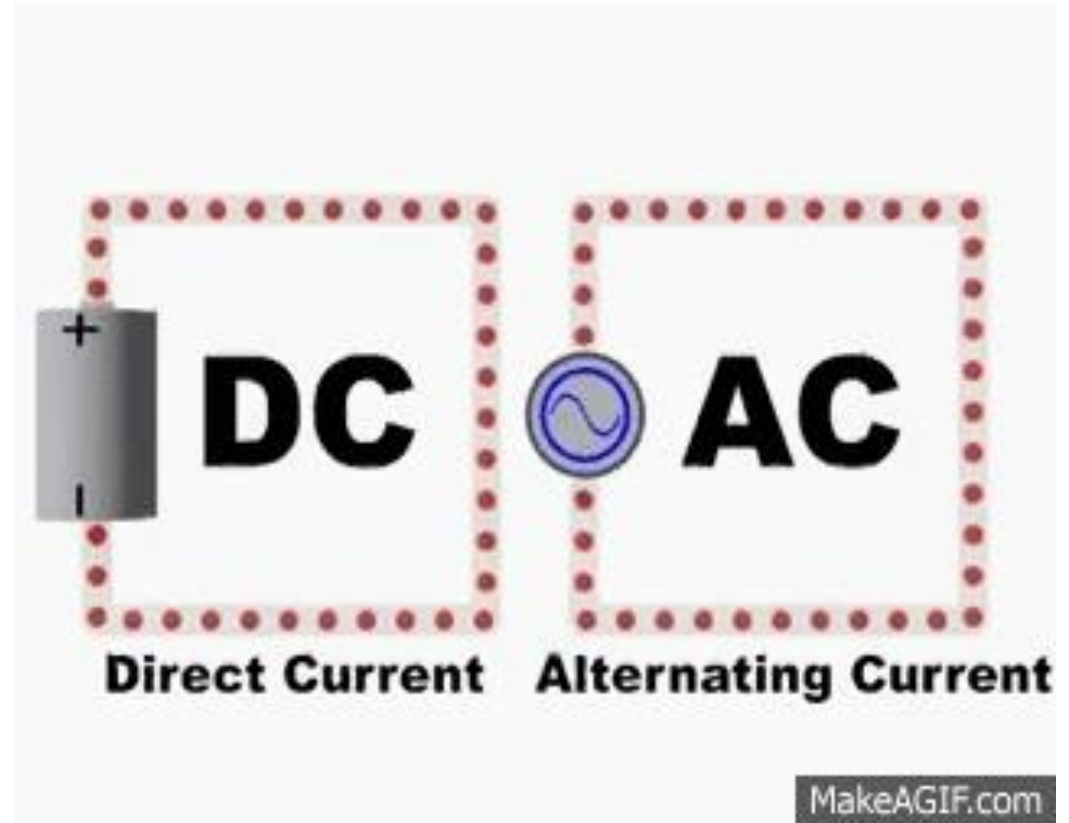


AC VOLTAGE
SOURCE



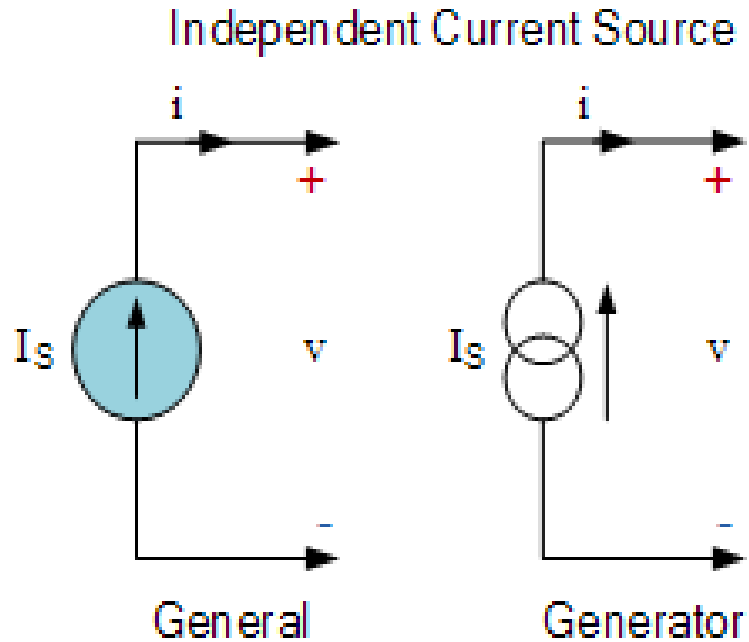
DC VOLTAGE
SOURCE

Circuit Symbol

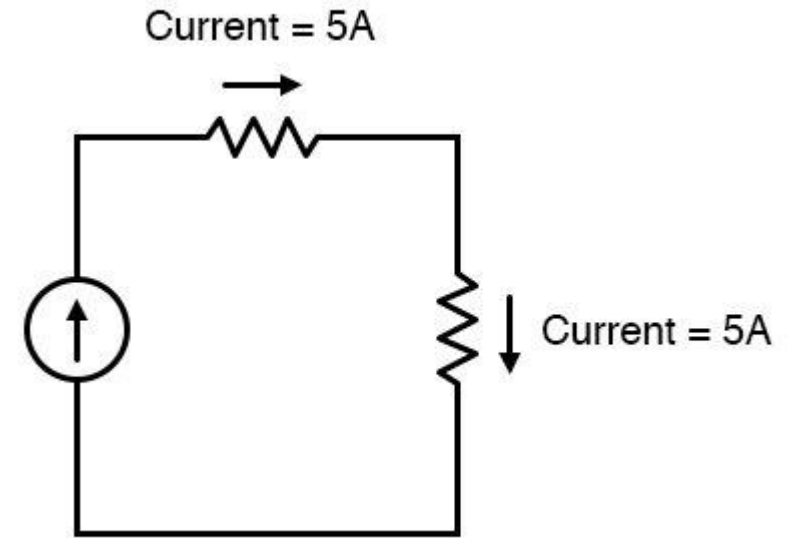


Electrical Circuit

❖ **CURRENT SOURCE**: A current source is an electronic circuit that delivers or absorbs an electric current which is independent of the voltage across it.



Circuit Symbol



Electrical Circuit

BASIC ELEMENTS OF ELECTRICAL ENGINEERING

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graph TD; A[BASIC ELEMENTS OF ELECTRICAL ENGINEERING] --> B[RESISTOR]; A --> C[CAPACITOR]; A --> D[INDUCTOR];
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RESISTOR

CAPACITOR

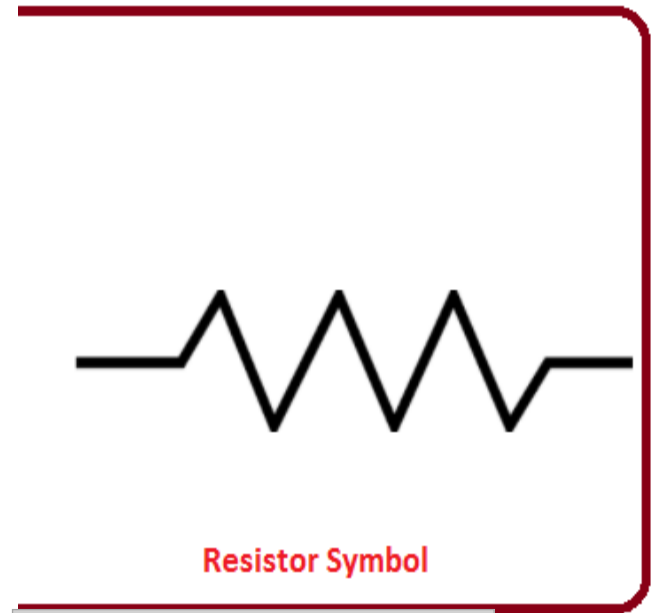
INDUCTOR

RESISTOR

- A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element.
- It opposes the flow of current in a circuit.



Resistors used in
laboratory



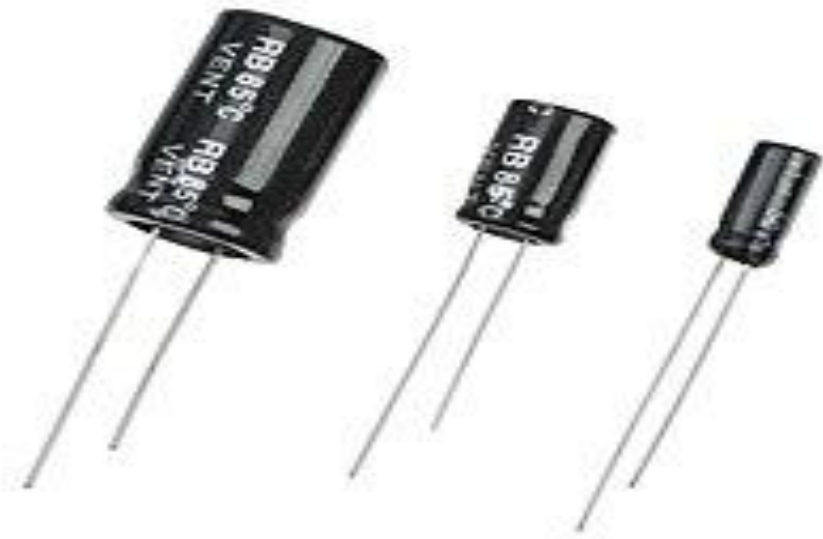
Resistors used in
circuit

RESISTANCE

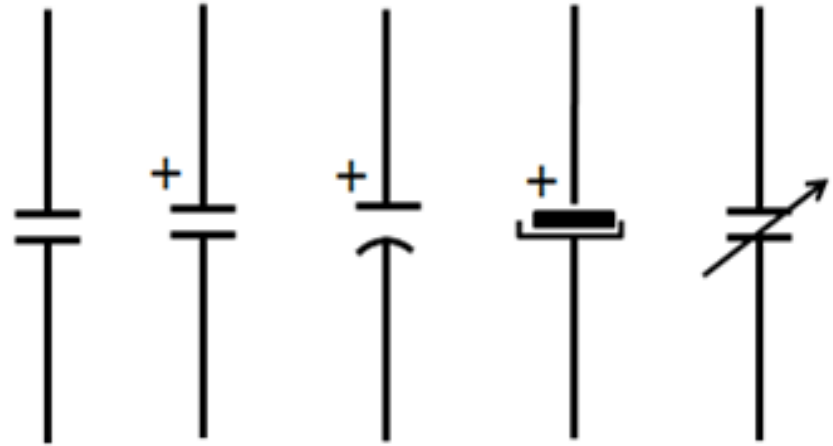
- (R) - property of a conductor by virtue of which the passage of current is opposed.
- Unit of resistance is Ohms (Ω)
- $R = V/I$

CAPACITOR

- A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field.



Capacitor used in
laboratory



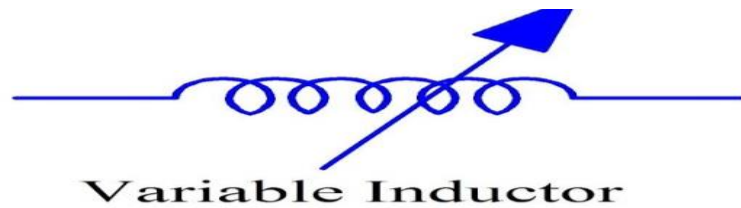
Capacitor used in
circuit

CAPACITANCE

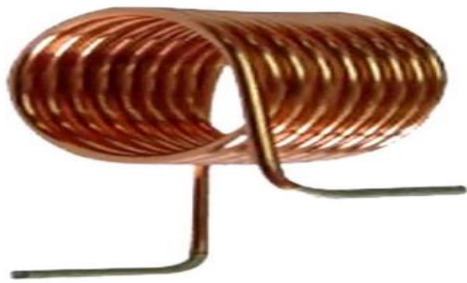
- the ability of a system to store an electric charge.
- Unit of capacitance is FARAD (F)
- $C = Q/V$ where Q = charge stored and V = potential or voltage

INDUCTOR

- An inductor, also called a coil, choke, or reactor, is a passive two-terminal electrical component that stores energy in a magnetic field when electric current flows through it.



Variable Inductor



Inductor used in
laboratory



Iron Core Inductor



Inductor

Inductor used in
circuit

INDUCTANCE

- inductance is the tendency of an electrical conductor to oppose a change in the electric current flowing through it.
- Unit of inductance is HENRY (H)
- If a time varying current flowing through a coil there is an emf induced in it. The induced emf across the coil is directly proportional to the rate of change of current with respect to time. Due to the property inducing emf, all types of electrical coil can be referred as inductor. An inductor is an energy storage device which stores energy in form of [magnetic field](#).

Instruments used in laboratory....

1) AMMETER: An instrument for measuring the flow of electrical current in amperes. Ammeters are always connected in series with the circuit to be tested.

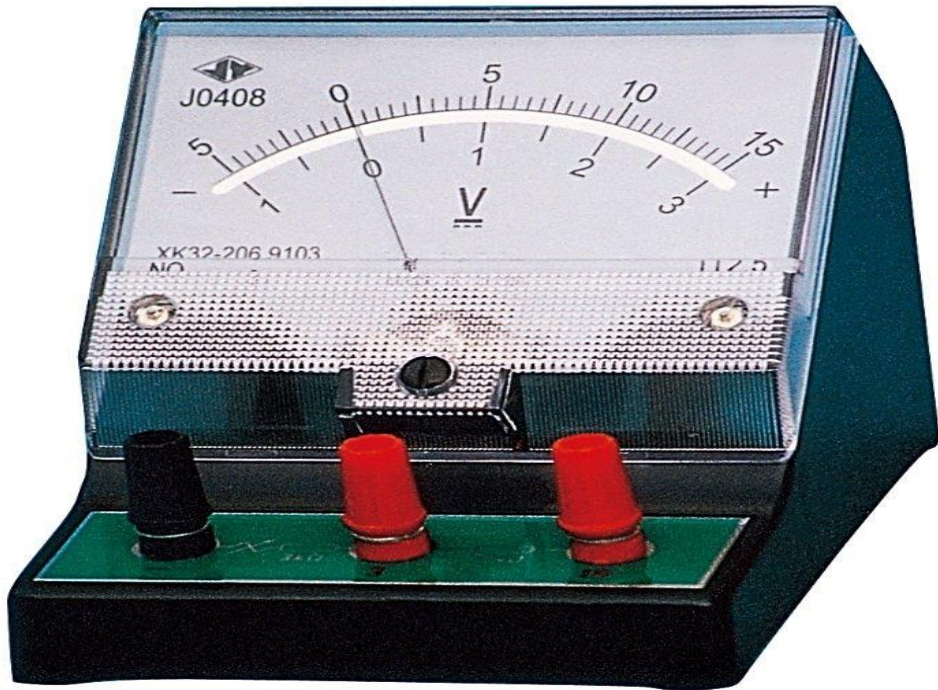


DC Ammeter



AC Ammeter

2) VOLTMETER: An instrument for measuring the force in volts of an electrical current. This is the difference of potential (voltage) between different points in an electrical circuit. Voltmeters have a high internal resistance and are connected across (parallel to) the points where voltage is to be measured.



DC Voltmeter



AC Voltmeter

3) WATTMETER: The wattmeter is an instrument for measuring the electric power (or the supply rate of electrical energy) in watts of any given circuit.



4) MULTIMETER: A multimeter or a multimeter, also known as a VOM (volt-ohm-milliammeter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current, and resistance



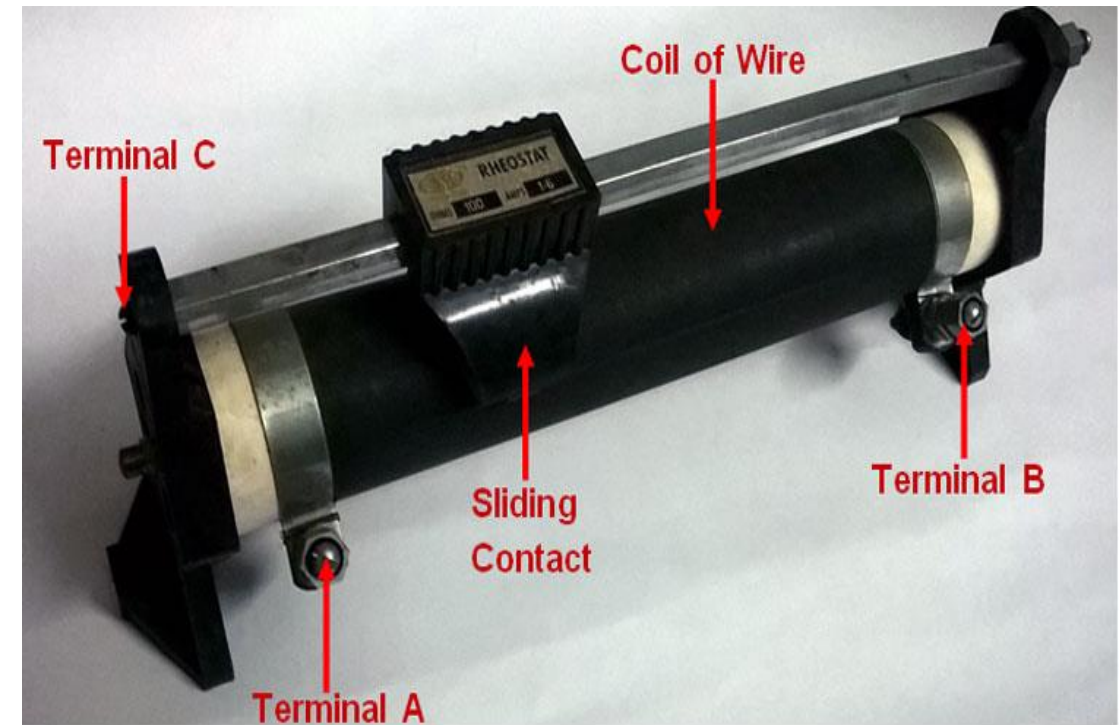
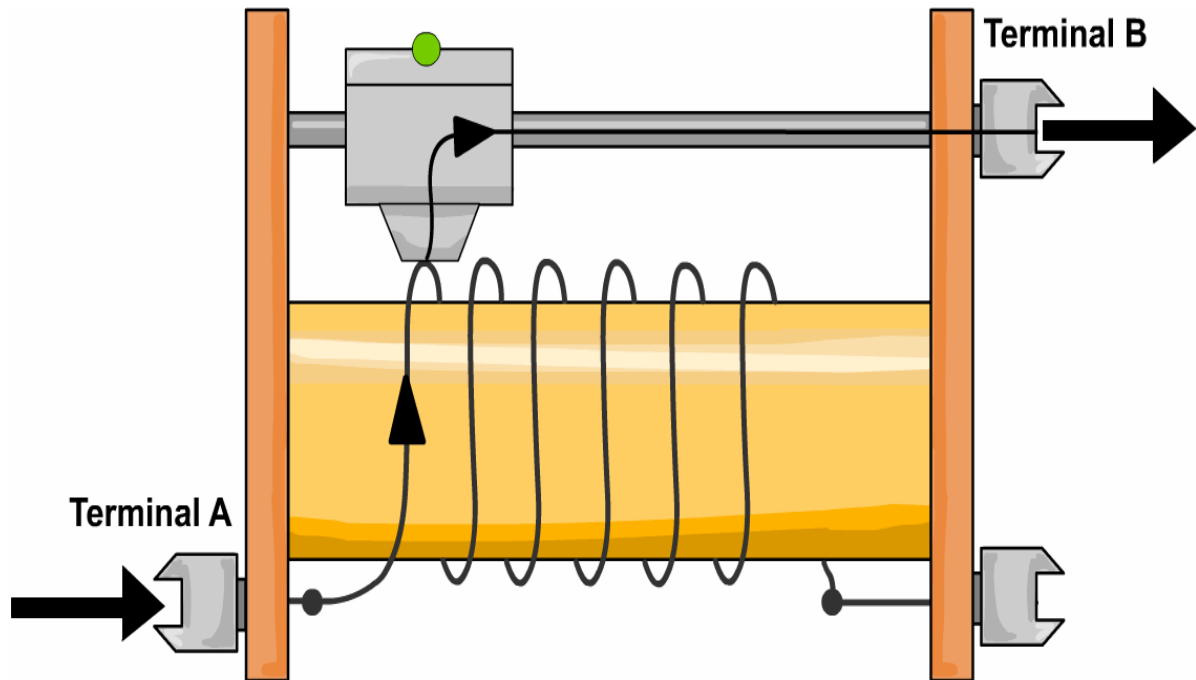
5) TRANSFORMER: A **Transformer** is a static electrical machine which transfers AC electrical power from one circuit to the other circuit at the constant frequency, but the voltage level can be altered that means voltage can be increased or decreased according to the requirement.



6) VARIAC: **Variacs** are **used** in experiments and testing to simulate various voltage and line conditions. Electrical equipment designed for a voltage other than the 120V or 240V supplied domestically can be powered at the intended voltage level with a **variac**.



7) RHEOSTAT: **Rheostat**, adjustable resistor used in applications that require the adjustment of current or the varying of resistance in an electric circuit.



CONCLUSION: From this experiment we understood the details of Basic Electrical Engineering laboratory.