Lab Components

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RESISTOR

By V.Ryan

INDEX

WHAT IS RESISTOR ??

- A RESISTOR IS A PASSIVE TWO-TERMINAL ELECTRICAL COMPONENT THAT IMPLEMENTS ELECTRICAL RESISTANCE AS A CIRCUIT ELEMENT.

- THE RATIO OF THE VOLTAGE APPLIED ACROSS A RESISTOR'S TERMINALS TO THE INTENSITY OF CURRENT THROUGH THE CIRCUIT IS CALLED RESISTANCE.

- THIS RELATION IS REPRESENTED BY OHM'S LAW:

$$V = I R$$

UNIT & SYMBOL

- THE OHM (SYMBOL: Ω) IS THE SI UNIT OF ELECTRICAL RESISTANCE, NAMED AFTER GEORG SIMON OHM.

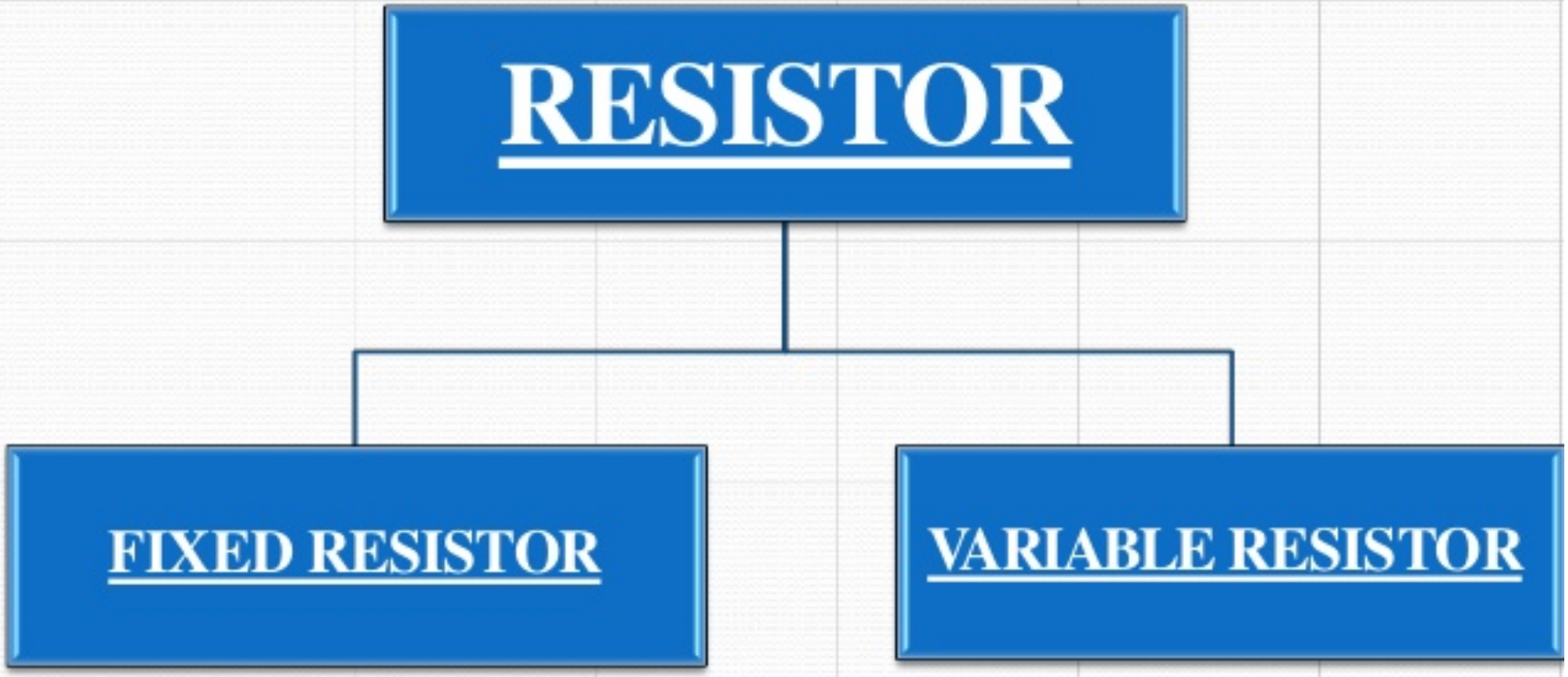
- AN OHM IS EQUIVALENT TO A VOLT PER AMPERE

- OTHER DERIVED UNITS ARE MILLI OHM (1 MΩ = 10^{-3} Ω), KILO OHM (1 KΩ = 10^{3} Ω), AND MEGA OHM (1 MΩ = 10^{6} Ω).

FIXED RESISTOR

VARIABLE RESISTOR

TYPES OF RESISTOR



FIXED RESISTOR

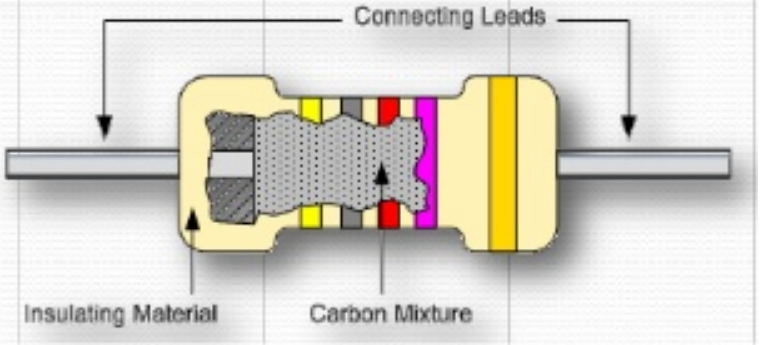
- CARBON COMPOSITE RESISTOR
- FILM RESISTOR
- WIRE WOUND RESISTOR
- RESISTANCE WIRE

VARIABLE RESISTOR

- RHEOSTAT
- POTENTIOMETER
- THERMISTOR
- HUMISTOR
- VARISTOR
- PHOTORESISTOR

CARBON COMPOSITE RESISTOR

- LOW INDUCTANCE
- IDEAL FOR HIGH FREQUENCY APPLICATIONS
- VERY CHEAP TO MAKE
- HAVE VERY LARGE TOLERANCES

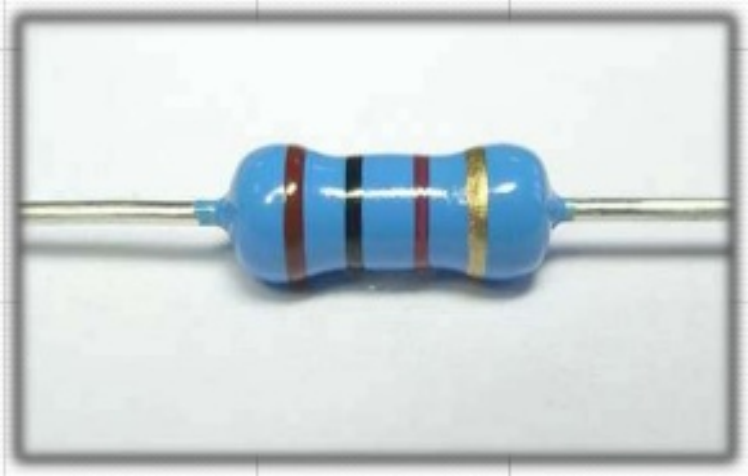


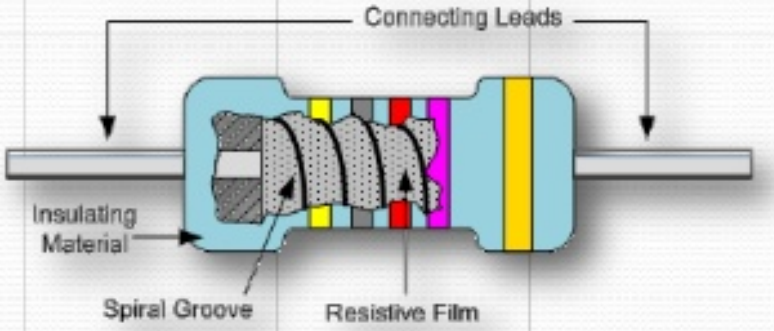
FILM RESISTOR

- THE RESISTIVE VALUE OF THE RESISTOR IS CONTROLLED BY INCREASING THE DESIRED THICKNESS OF THE DEPOSITED FILM.

- RESISTANE UPTO 10MΩ CAN BE OBTAINED.

- HAVE TOLERANCE 1% OR LESS

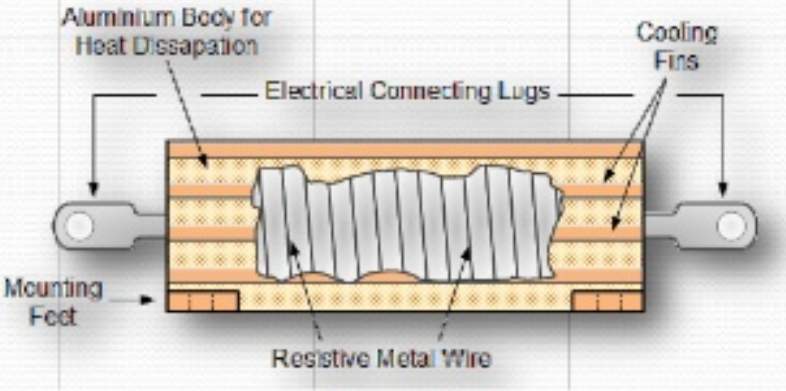




WIRE WOUND RESISTOR

- MADE BY WINDING A THIN METAL ALLOY WIRE ONTO AN INSULATING CERAMIC FORMER IN THE FORM OF A SPIRAL HELIX

- AVAILABLE IN VERY LOW OHMIC AND HIGH PRECISION VALUES (FROM **0.01** TO **100**KΩ)



RHEOSTAT

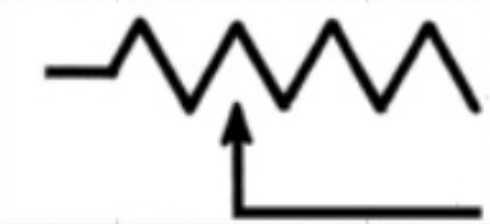
- RHEOSTAT IS A ADJUSTABLE RESISTOR USED IN APPLICATIONS THAT REQUIRE ADJUSTMENT OF CURRENT OR VARYING OF RESISTANCE IN AN ELECTRIC CIRCUIT

- A SPECIAL TYPE OF RHEOSTAT IS THE POTENTIOMETER

POTENTIOMETER

- A POTENTIOMETER IS, A POT, IN ELECTRONICS TECHNOLOGY IS A THREE-TERMINAL RESISTOR WITH A SLIDING CONTACT THAT FORMS AN ADJUSTABLE VOLTAGE DIVIDER.

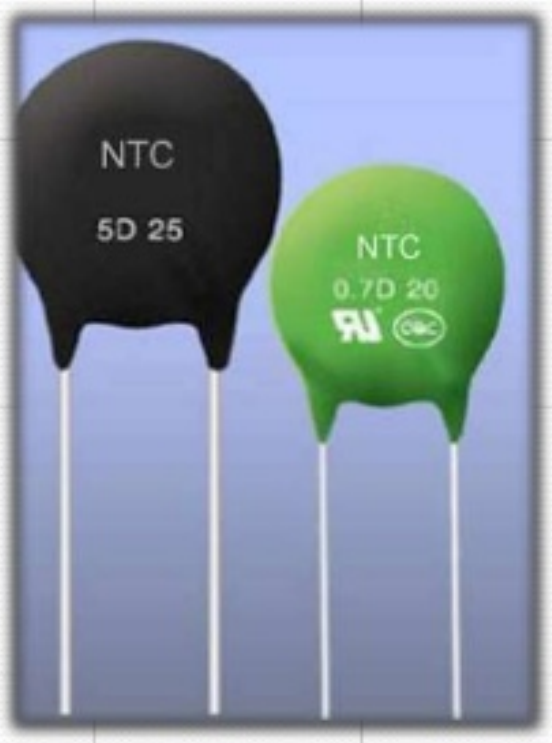
- POTENTIOMETERS ARE COMMONLY USED TO CONTROL ELECTRICAL DEVICES SUCH AS VOLUME CONTROLS, JOYSTICKS ETC.



THERMISTOR

- A THERMISTOR IS A TYPE OF RESISTOR WHOSE RESISTANCE VARIES SIGNIFICANTLY WITH TEMPERATURE

- THERMISTORS CAN BE USED AS CURRENT-LIMITING DEVICES FOR CIRCUIT PROTECTION, AS REPLACEMENTS FOR FUSES



HUMISTOR

- A HUMISTOR IS A TYPE OF RESISTOR WHOSE RESISTANCE VARIES SIGNIFICANTLY WITH HUMIDITY

- A HUMIDITY SENSOR MEASURES THE HUMIDITY LEVEL BY MEASURING THE CHANGE IN THE RESISTANCE OF AN ELEMENT

VARISTOR

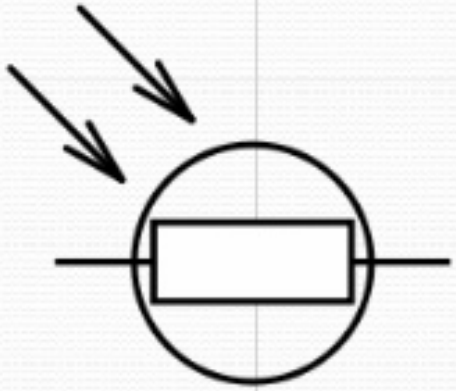
- A VARISTOR (OR VOLTAGE DEPENDENT RESISTOR) FUNCTION IS TO CONDUCT SIGNIFICANTLY INCREASED CURRENT WHEN VOLTAGE IS EXCESSIVE.

HIGH VOLTAGE VARISTOR

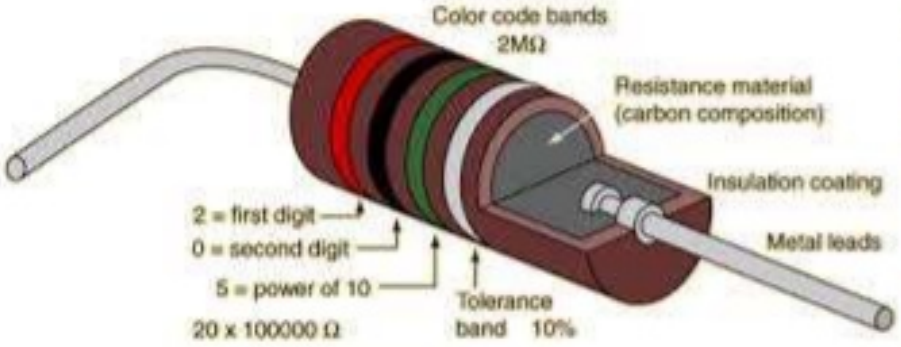
PHOTORESISTOR

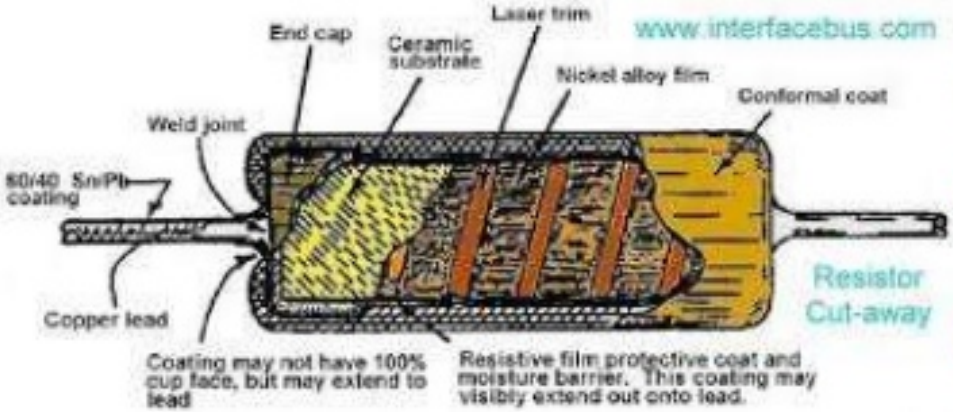
- A PHOTORESISTOR OR LIGHT DEPENDENT RESISTOR (LDR) EXHIBITS PHOTOCONDUCTIVITY.

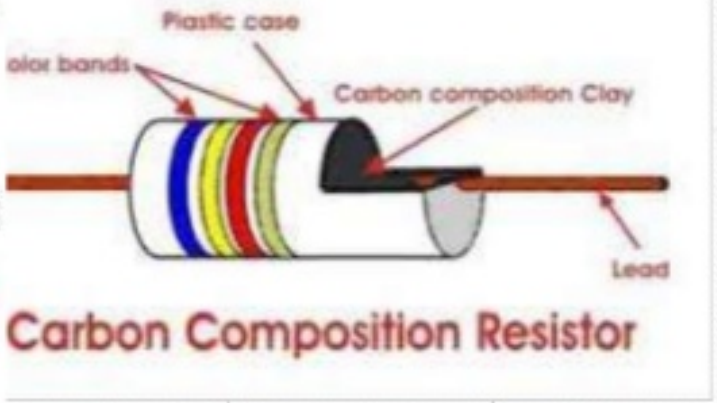
- PHOTORESISTORS IN MANY CONSUMER ITEMS SUCH AS STREET LIGHTS, CLOCK RADIOS, ALARM DEVICES ETC



TYPES OF RESISTOR







SERIES CONNECTION

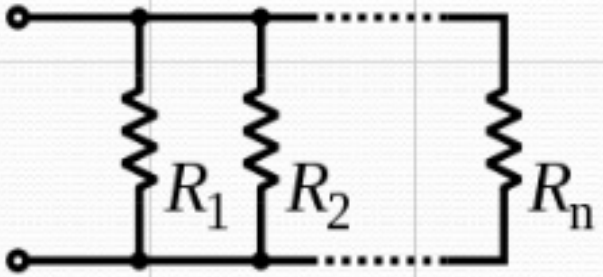
$$R_{eq} = R_1 + R_2 + \cdots + R_n$$

- **IN SERIES CONNECTION, THE CURRENT REMAINS CONSTANT.**
  (i.e. $I = I_1 = I_2 = \ldots = I_n$)

- **IN SERIES CONNECTION, VOLTAGE ADDS UP.**
  (i.e. $V = V_1 + V_2 + \ldots + V_n$)

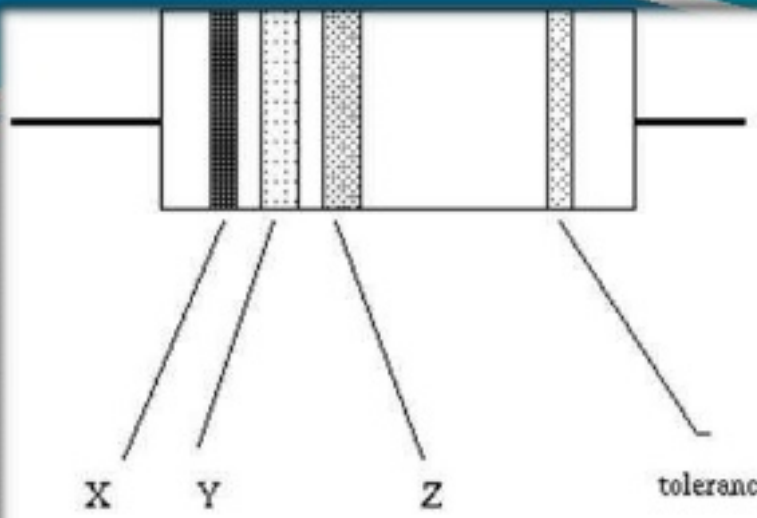
PARALLEL CONNECTION

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$



- **IN PARALLEL CONNECTION, THE VOLTAGE REMAINS CONSTANT.**
  (i.e. $V = V_1 = V_2 = \ldots = V_n$)

- **IN PARALLEL CONNECTION, CURRENT ADDS UP.**
  (i.e. $I = I_1 + I_2 + \ldots + I_n$)

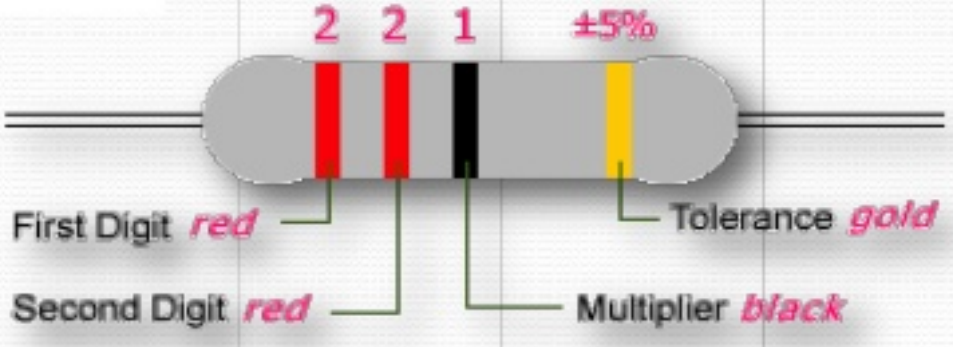


color code	
0 black	5 green
1 brown	6 blue
2 red	7 purple
3 orange	8 grey
4 yellow	9 white

RESISTOR VALUE = XY * Z ± TOLERANCE

EXAMPLE:-

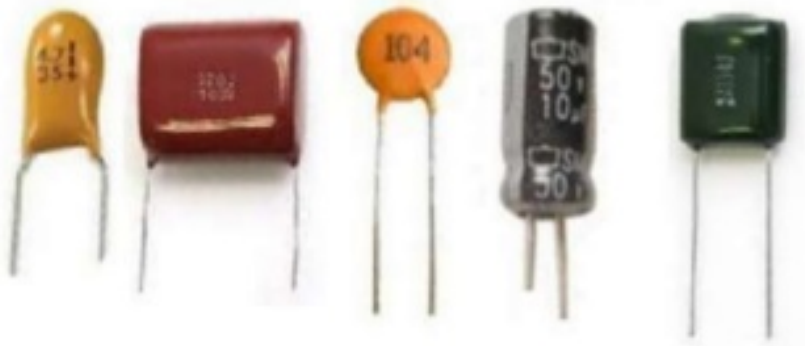
FIND THE RESISTANCE OF THE GIVEN RESISTOR ?



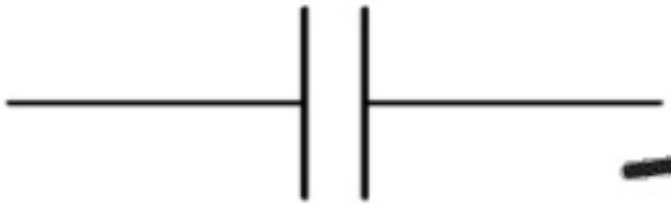
A 22Ω Resistor
22×1 Ohms with a tolerance rating of ±5%

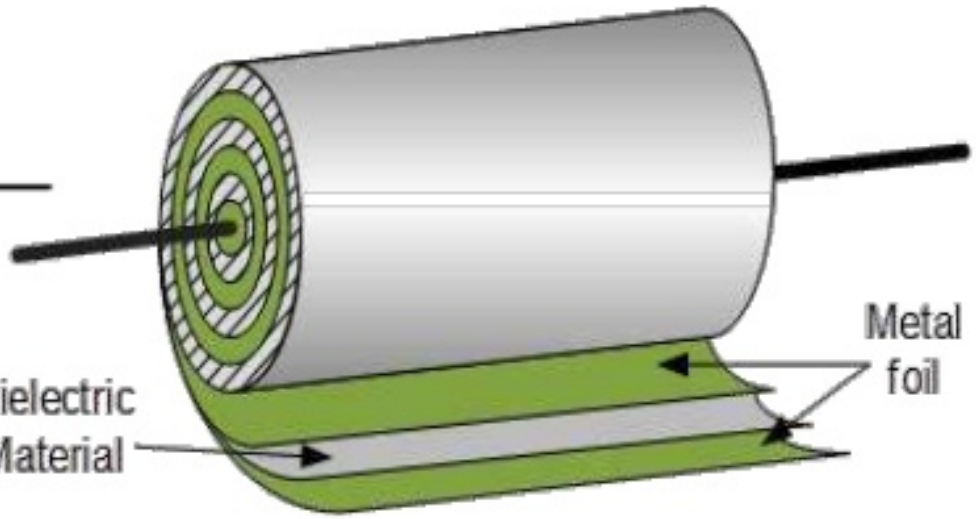
COLOUR CODE TABLE

COLOUR	DIGIT	MULTIPLIER	TOLERANCE
BLACK	0	10^0	-
BROWN	1	10^1	± 1%
RED	2	10^2	± 2%
ORANGE	3	10^3	-
YELLOW	4	10^4	-
GREEN	5	10^5	± 0.5%
BLUE	6	10^6	± 0.25%
VIOLET	7	10^7	± 0.1%
GREY	8	10^8	-
WHITE	9	10^9	-
GOLD	-	10^{-1}	± 5%
SILVER	-	10^{-2}	± 10%
NONE	-	-	± 15%



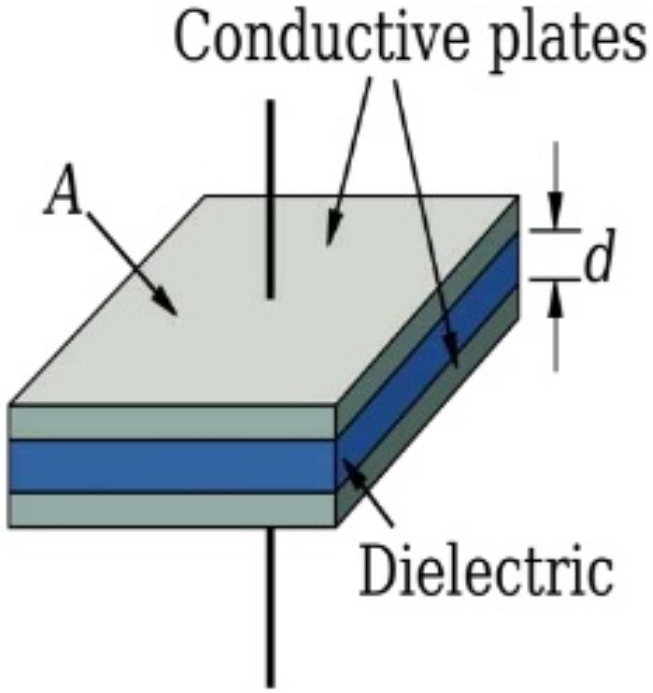
CAPACITOR





What is the capacitor?

The capacitor is passive device consists of tow plats and separated by an insulator material.



Reason for use the capacitor in the circuit is a **storage the energy.**

The Symbol of Capacitor

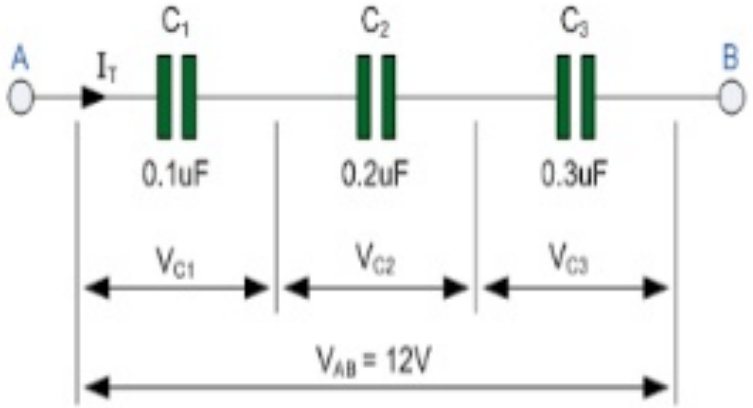
The Unity of Measurement The Capacitor

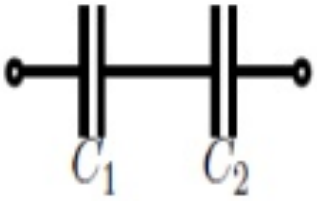
farad (F)

µF uF mF	MICROFARAD	10^{-6}F
nF	NANOFARAD	10^{-9}F
pF mmf uuf	PICOFARAD	10^{-12}F

Connection of capacitor in series

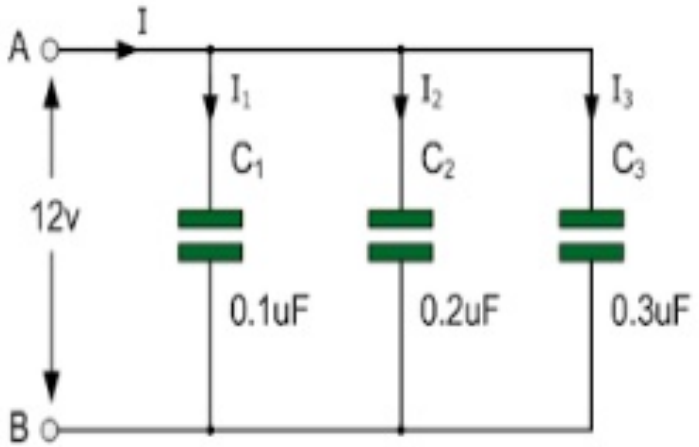
- Equivalent Circuit
- Formula
- Examples

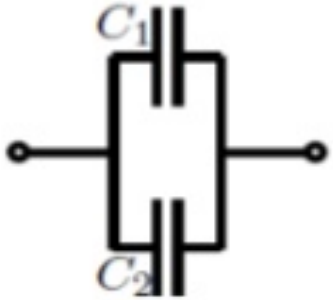


SERIES		$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2}$

Connection of capacitor in parallel

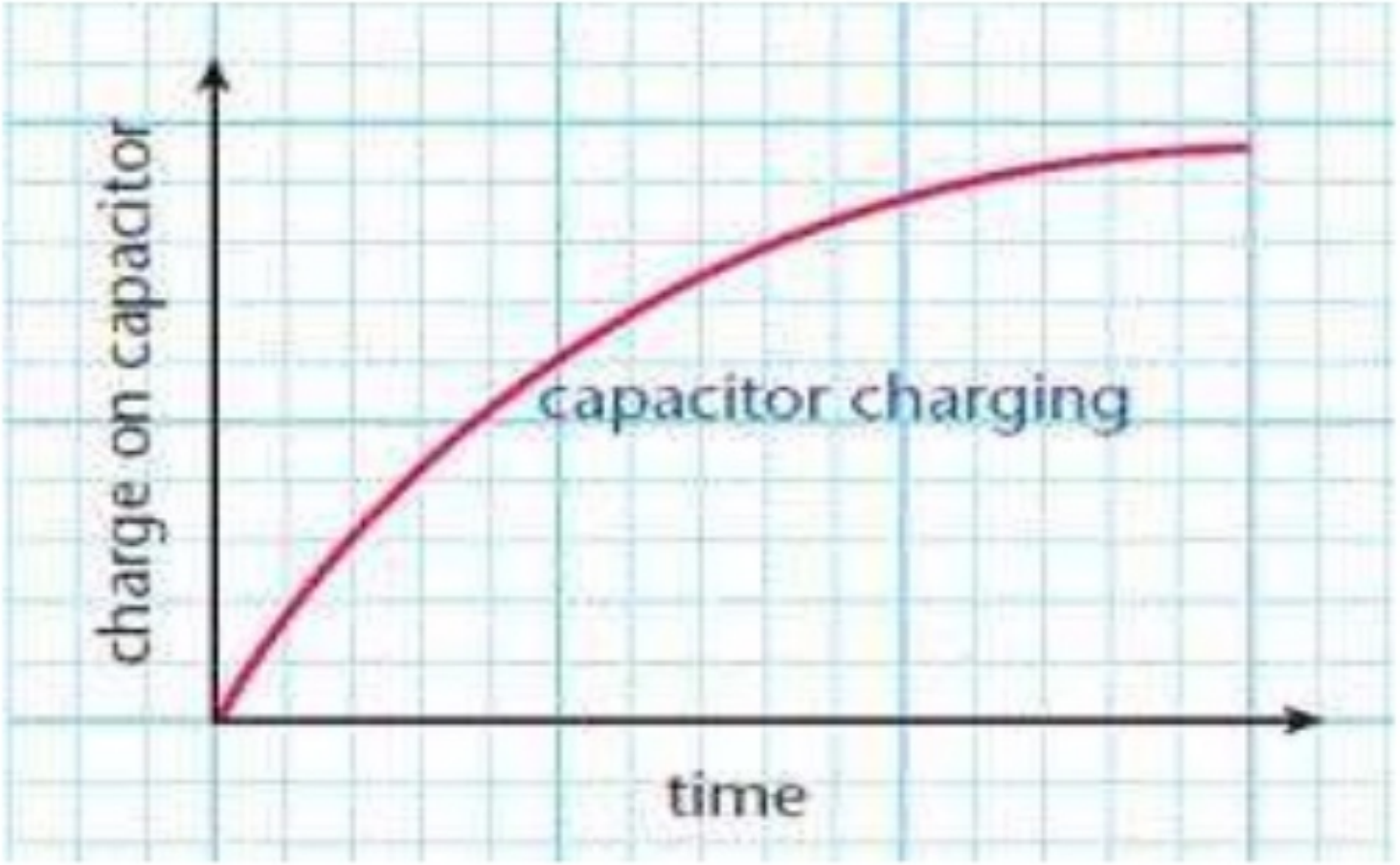
- Equivalent Circuit
- Formula
- Examples



PARALLEL		$C_p = C_1 + C_2$

Charging the capacitor (curve).

Charging

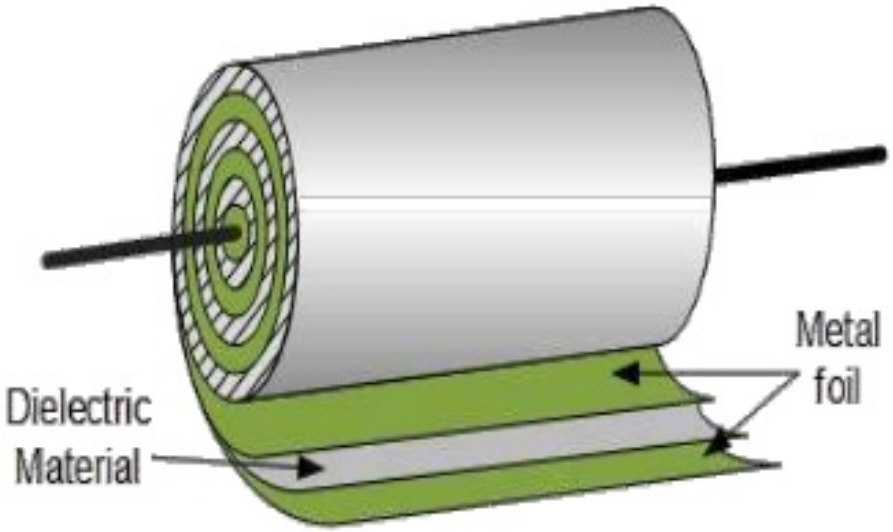


Discharging the capacitor (curve)

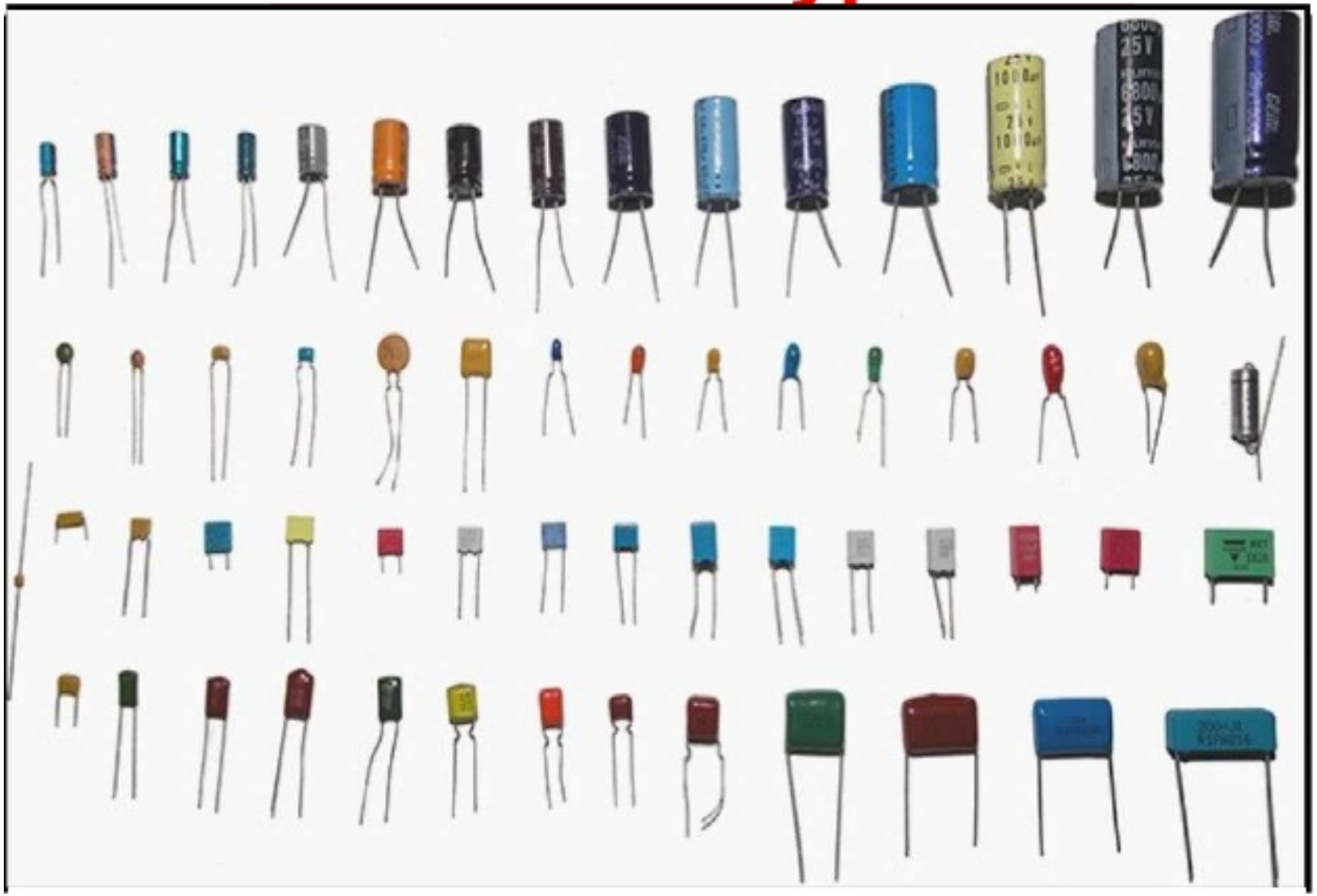
- Discharging

How we can make a simple capacitor?

- **What are the materials that we will use to make a simple capacitor?**
- **How we can make it ?**

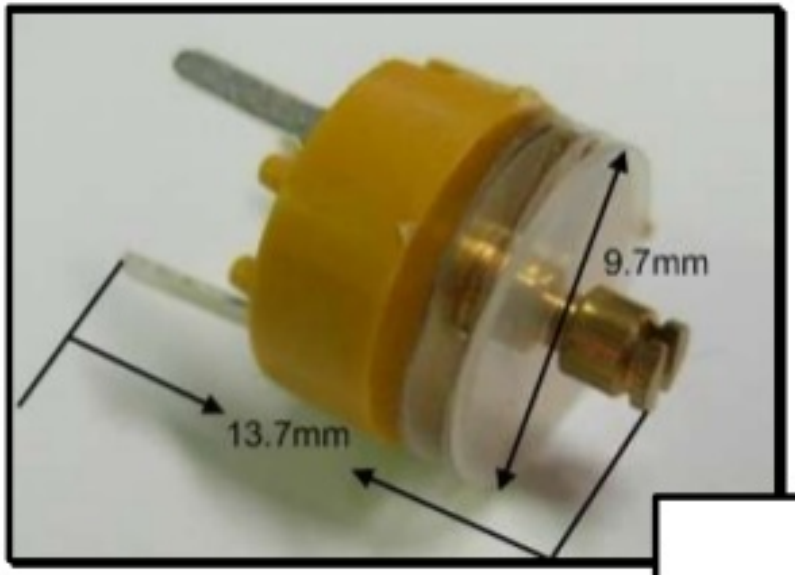


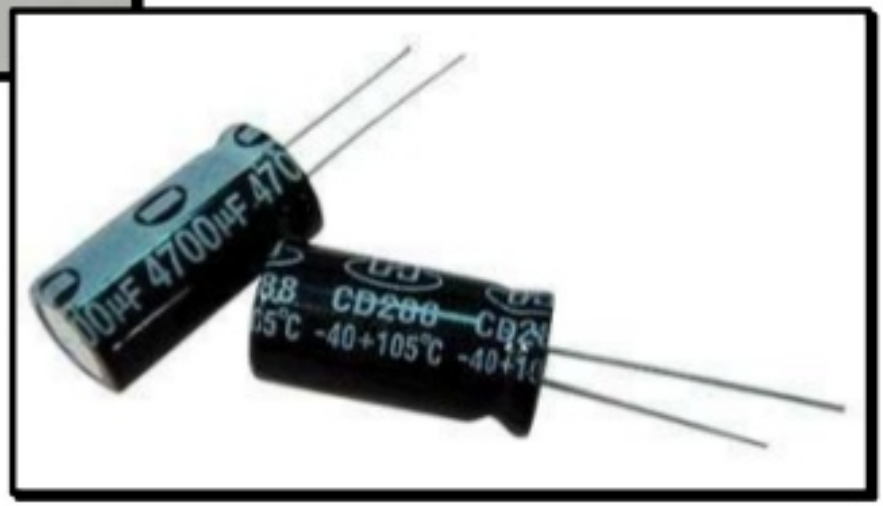
Different Types Of



Reading Values of capacitance Capacitors

Fixed And Variable Capacitors

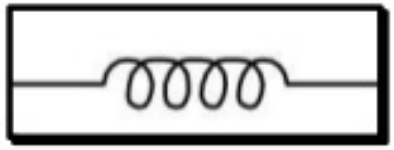




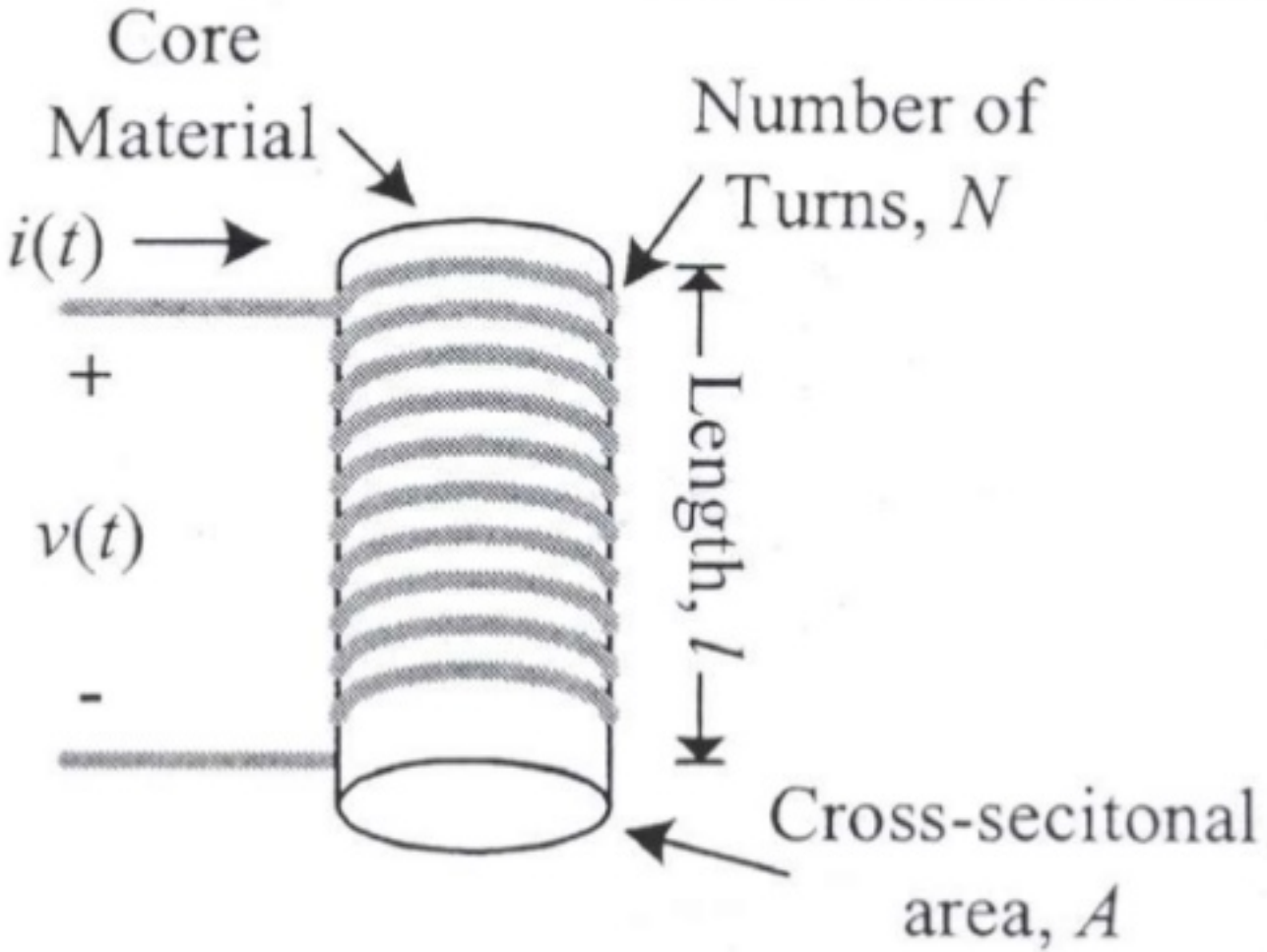
Inductor

Inductors

- ***Definition: An inductor is a passive electronic component that stores energy in the form of a magnetic field.***
- In its simplest form, an inductor consists of a wire loop or coil. The inductance is directly proportional to the number of turns in the coil.
- Inductance also depends on the radius of the coil and on the type of material around which the coil is wound.



Inductor


Core
Material
Number of
Turns, N
i(t)
+
v(t)
-
Length, l
Cross-secitonal
area, A

Ferromagnetic Core Inductor or Iron-core Inductors

- This type uses ferromagnetic materials such as ferrite or iron in manufacturing the inductor for increasing the inductance. Due to the high magnetic permeability of these materials, inductance can be increased in response of increasing the magnetic field.
- At high frequencies it suffers from core loses, energy loses, that happens in ferromagnetic cores
- FERRITE CORE - For tuned circuits at Higher Frequencies.

Air Core Inductor

Air Core inductor

- Air cored inductor is the type where no solid core exists inside the coils. In addition, the coils that wound on nonmagnetic materials such as ceramic and plastic, are also considered as air cored. This type does not use magnetic materials in its construction.
- The main advantage of this form of inductors is that, at high magnetic field strength, they have a minimal signal loss. On the other hand, they need a bigger number of turns to get the same inductance that the solid cored inductors would produce. They are free of core losses because they are not depending on a solid core.
- AIR CORE - used for Radio Frequencies.

Toroidal Core Inductor

- Toroidal Inductor constructs of a circular ring-formed magnetic core that characterized by it is magnetic with high permeability material like iron powder, for which the wire wounded to get inductor. It works pretty well in AC electronic circuits' application.
- The advantage of this type is that, due to its symmetry, it has a minimum loss in magnetic flux; therefore it radiates less electromagnetic interference near circuits or devices. Electromagnetic interference is very important in electronics that require high frequency and low power.

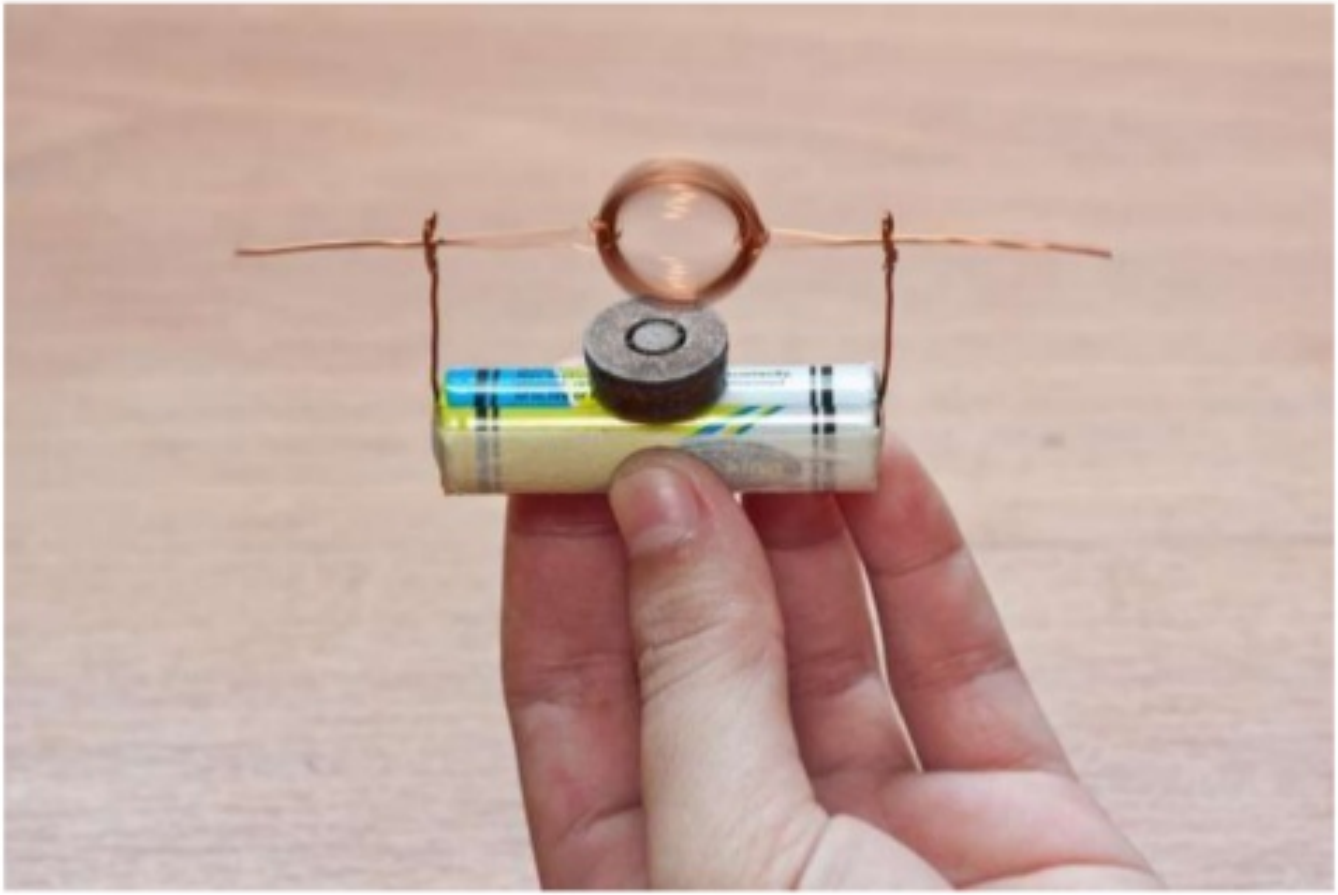
Laminated Core Inductor

- This form gets typified by its stacks made with thin steel sheets, on top of each other designed to be parallel to the magnetic field covered with insulating paint on the surface; commonly on oxide finish. It aims to block the eddy currents between steel sheets of stacks so the current keeps flowing through its sheet and minimizing loop area for which it leads to great decrease in the loss of energy. Laminated core inductor is also a low frequency inductor. It is more suitable and used in transformer applications.
- LAMINATED RON CORE - used for Low Frequencies.

Powdered Iron Core

- Its core gets constructed by using magnetic materials that get characterized by its distributed air gaps. This gives the advantage to the core to store a high level of energy comparing to other types. In addition, very good inductance stability is gained with low losses in eddy current and hysteresis. Moreover, it has the lowest cost alternative.
- POWDERED RON CORE - used for Low Frequencies

Inductor Genre tar



Thank you