• UNIT – 1 :– BASIC OF ELECTRONIC COMPONENTS

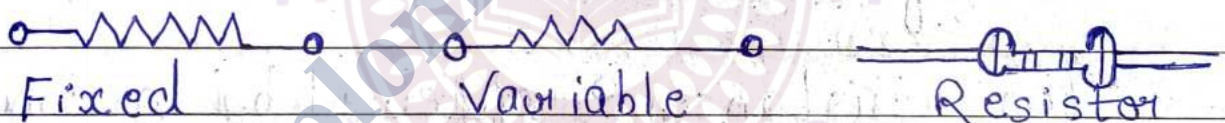
In electrical and electronic engineering we frequently come across two terms "circuit" and "circuit element". Where an electric circuit element is the most elementary building block of an electric circuit, and the electric circuit is an interconnection of different circuit elements connected in a fashion so they form a closed path for current to flow.

Technically, an electric circuit element is the mathematical model of an electrical device and can be completely characterized by its voltage and current relationship. Also, a circuit element being the most basic building block cannot be subdivided into other devices.

There are three most basic circuit elements that we use to form different electrical and electronic circuits are Resistor, Inductor, and Capacitor, In this article, we shall learn about these three elements in detail.

Q. What is a Resistor?

→ An electric circuit element that introduce an electrical friction or resistance in the path of electric current is called a resistor. The characteristic by which it oppose the flow of current is known as resistance. The resistance of a resister is denoted by symbol R and measured in Ohms (Ω). The typical circuit symbol of a resistor is known as the following figure.



Fixed Resistor | Variable Resistor | Resistor

The voltage across a resistor is directly proportional to the current flowing through it. Therefore, in terms of voltage current relationship, if the voltage across an element is directly proportional to the current through it, then the element is called a resistor.

* Resistance :—

It may be defined as the property of a substance due to which it opposes (or restricts) the flow of electricity (i.e., electrons) the flow of electricity (i.e., electrons) through it.

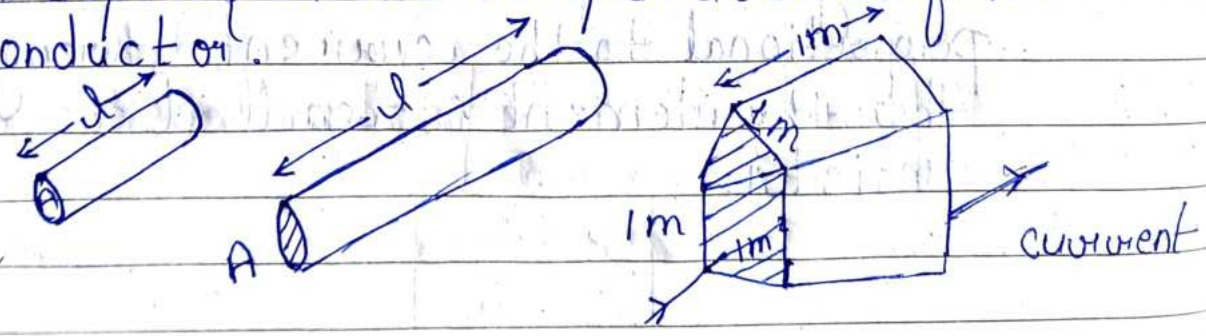
* The Unit of Resistance :—

The practical unit of resistance is ohm (Ω)

* Laws of Resistance :—

The resistance R offered by a conductor depends on the following factors:

(i) It varies directly as its length l.
(ii) It varies inversly as the cross-section of the conductor.
(iii) It depends on the temperature of the conductor.



Smaller l	Larger $\frac{1}{l}$
larger A	Smaller A
Low R	Greater R

→ Negative, the last factor for the time being, we can say that

$$R \propto \frac{1}{A} \quad \text{or} \quad R = \rho \frac{l}{A} \qquad \text{——(i)}$$

→ When ρ is a constant depending on the nature of the material of the conductor and is known as its specific resistance or resistivity.

If in Eq (i), we put

$l = 1$ metre and $A = 1$ metre^2

then $R = \rho$ (fig 1.4)

→ Hence, specific resistance of a material may be defined as the resistance between the opposite faces of a metre cube of that material.

* Units of Resistivity :—

From Eq (i), we have

$$\rho = \frac{AR}{l}$$

In the S.I system of units,

$$\rho = \frac{A \text{ metre}^2 \times R \text{ ohm}}{l \text{ metre}} = \frac{AR}{l} \text{ ohm-metre}$$

→ Hence, the unit of resistivity is ohm-metre (Ω-m)

Ohm's Law :—

This law applies to electric conduction through good conductors and may be stated as follows :—

The ratio of potential difference (V) between any two points on a conductor to the current (I) flowing between them, is constant, provided the temperature of the conductor does not change.

In other words, $\frac{V}{I} = \text{constant}$ or

$$\frac{V}{I} = R$$

Where R is the resistance of the conductor between the points considered.

Q. What is an Inductor?

→ Inductor is basically a wire of finite length twisted in to a coil. An inductor is also a basic circuit element that used to introduce inductor in an electrical or electronic circuit. The inductor has a property, know as inductance, which oppose any change in the electric current. The circuit symbol of a typical inductor is shown in following figure.

Inductor symbol

Inductor

In terms of voltage – current relationship, if a two terminal circuit element whose terminal voltage is directly proportional to derivative of current with respect to time, then the element is called an inductor. Therefore, the mathematical relation between voltage current of an inductor is given by:-

$$v \propto \frac{di}{dt}$$

$$v = L \frac{di}{dt}$$

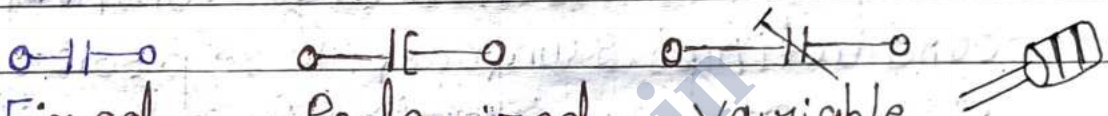
From this expression it is clear that the voltage across the inductor would be zero if the throug it remains constant. Hence, an inductor with DC behaves as a short-circuit coil. Also, if the current through the inductor changes within zero time, then it gives an infinite voltage across the inductor which is practically not possible. Consequently, the current through an inductor cannot change abruptly.

A very important property of an inductor is that it can store inductor is that it can store finite amount of energy in the form of magnetic field. An ideal inductor does not dissipate energy, but only store it.

Q. What is a Capacitor?

→ An electric circuit element that has an

ability of storing electrical energy is the form of electric field is called a capacitor. The property of the capacitor by virtue of which it store electrical energy is known as capacitance.



Capacitor symbols

In other words, a circuit element whose terminal voltage is directly proportional to integral of current with respect to time is called a capacitor, i.e.,

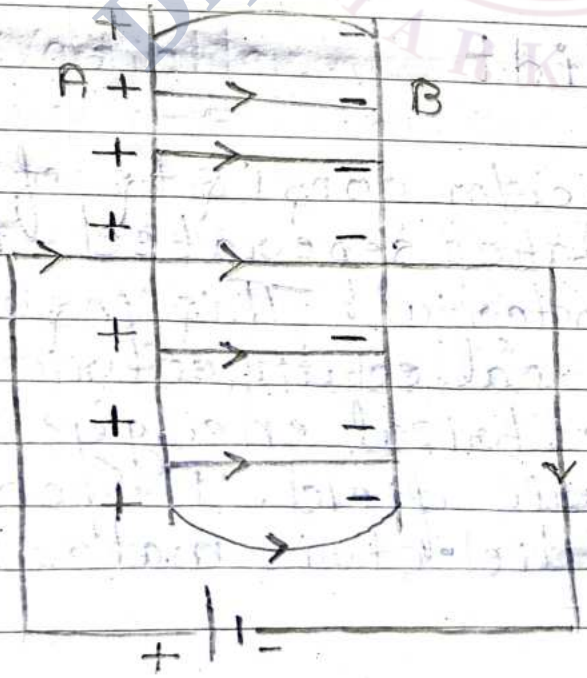
$$v = \int i\,dt$$

A simple capacitor consists of two metallic plates seperated by an insulating material. This insulating material is called dielectric and it stores the electrical energy in the form of electric field. Depending on the type of dielectric material used,

There are several types of capacitor like paper capacitor, air capacitor, mica capacitor, electrolytic capacitor etc.

Capacitor :—

→ A capacitor essentially consists of two conducting surfaces separated by a layer of an insulating medium called dielectric. The conducting surfaces may be in the form of either circular plates or be of spherical or cylindrical shape. The purpose of the capacitor is to store electrical energy by electrostatic stress in the dielectric. It is a misnomer since a capacitor does not 'condense' electricity as such, it :-



* Capacitance :-

The property of a capacitor to 'store electricity' may be called its capacitance. The capacitor of a capacitor is defined as "the amount of charge required to create a unit p.d between its plates".

Suppose we give Q coulomb of charge to one of the two plate of capacitor and if a p.d of volts is established between the two, then its capacitor is

$$C = \frac{Q}{V}$$

Charge / Potential difference

Hence, capacitance is the charge required per unit potential difference.

The unit of capacitance is coulomb/volt which is also called farad.

$$1 \text{ farad} = \frac{1 \text{ coulomb}}{\text{volt}}$$

One farad is defined as the capacitance of a capacitor which requires a charge

of one coulomb to establish a P.d. of the one volt between its plates.

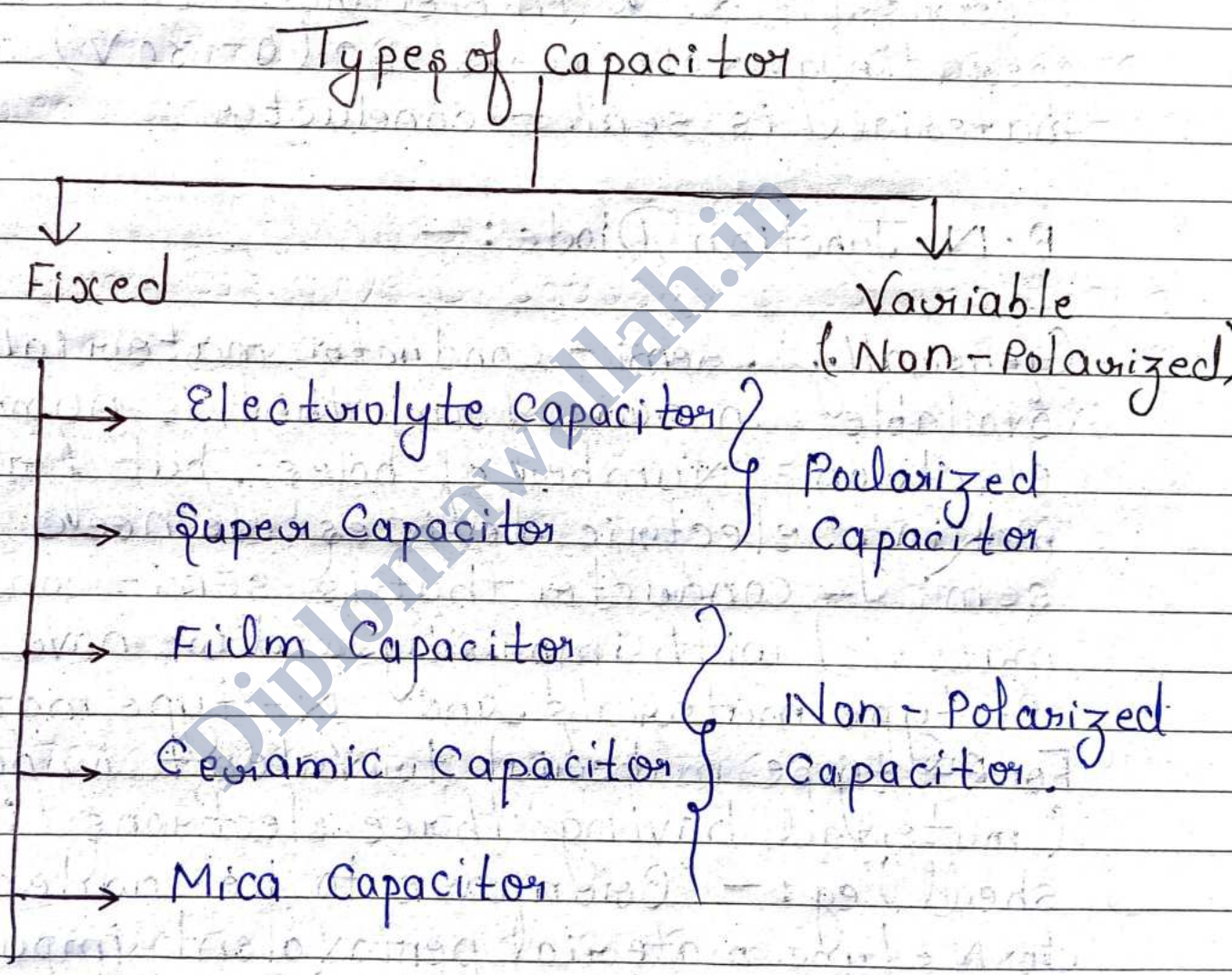
$1\mu F = 10^{-6} F$, $1 nF = 10^{-9} F$, $1 PF = 10^{-12} F$

μF = microfarad
nF = nanofarad
PF = Picofarad

Resistor (types)

- Linear
  - fixed resistor
    - Fixed
      - Carbonic Composition
      - Thin film
      - Thick film
      - Wire wound
  - Variable resistor
    - Variable
      - Potentiometer
      - Trimmer
      - Rheostat
      - Trimpot
- Non-linear
  - Thermistor
  - LDR
  - Varistor
  - Photo resistor

* Rheostat :- When they are use as a variable resistor to control the current in a circuit is called rheostat.



Q. What is Electronics?

→ It is a branch of engineering which deals with moment of electron in different electric field. In electronic basically operating voltage is DC (0 - 30 V) and material is semi - conductor.

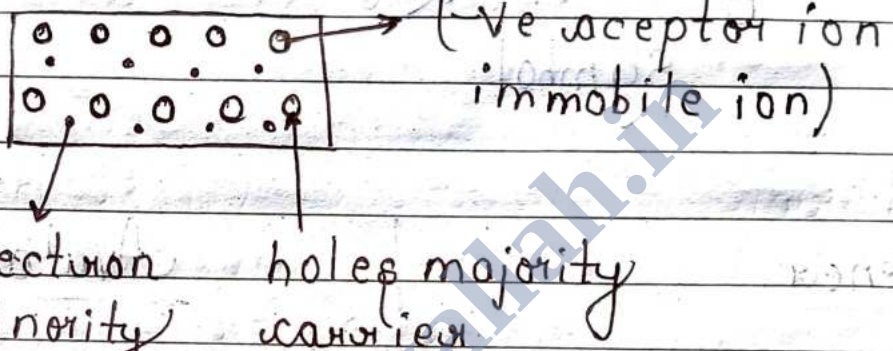
P.N. Junction Diode :-

Generally, semi - conductor materials are available in pure form that is number of electron = Number of holes, but for making electric devices we need impure semi - conductor that is semi - conductor material with impurity and we have to make P - type materials and N - type materials. For P - type material trivalent impurity (material having three electrons in outer shell) eg :- Boron are to be added and for N - type material pentavalent impurity should be added (material having five electron in outer shell. eg :- Phosphorus).

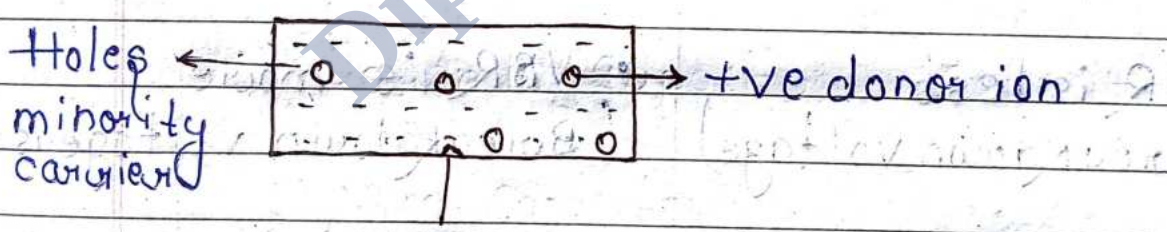
Process of adding impurity is known as dopping. P - type material is having holes as a majority carrier and electrons as a minority carrier and in

N-type material electron is a majority carrier and holes as a minority carrier.

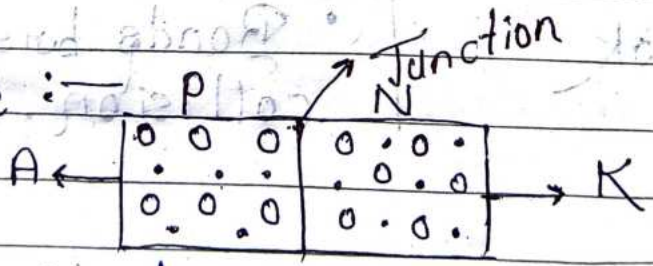
- P-type Material :-



- N-type Material :-

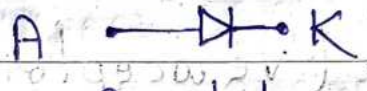


* Diode :-



Construction.

When P-type material is combined with N-type material such that crystal structure remains continuous across the junction is known as P.N Junction diode or diode.



Symbol

* Zener	Avalanch
(i) Highly doped.	• Lightly doped.
(ii) Potential barrier is less (W is less)	• Potential barrier is more (W is increase.)
(iii) V_{BR} is less (Breakdown voltage)	• V_{BR} is more. (Breakdown voltage is more)
(iv) Heating effect is less.	• Heating effect is more.
(v) Bonds break directly	• Bonds break due to collision.

Q. When the reverse current in a particularly zener diode increase from 20mA to 30mA, the zener voltage change from 5.6V to 5.65V. What will be the resistance of the device?

→ $\Delta I_Z = 30\,mA - 20\,mA$

$= 10\,mA$

$\Delta V_Z = 5.65\,V - 5.6\,V$

$= 0.05\,V$

$$R_Z = \frac{\Delta V_Z}{\Delta I_Z}$$

$$= \frac{0.05}{10 \times 10^{-3}\,A} \times 100$$

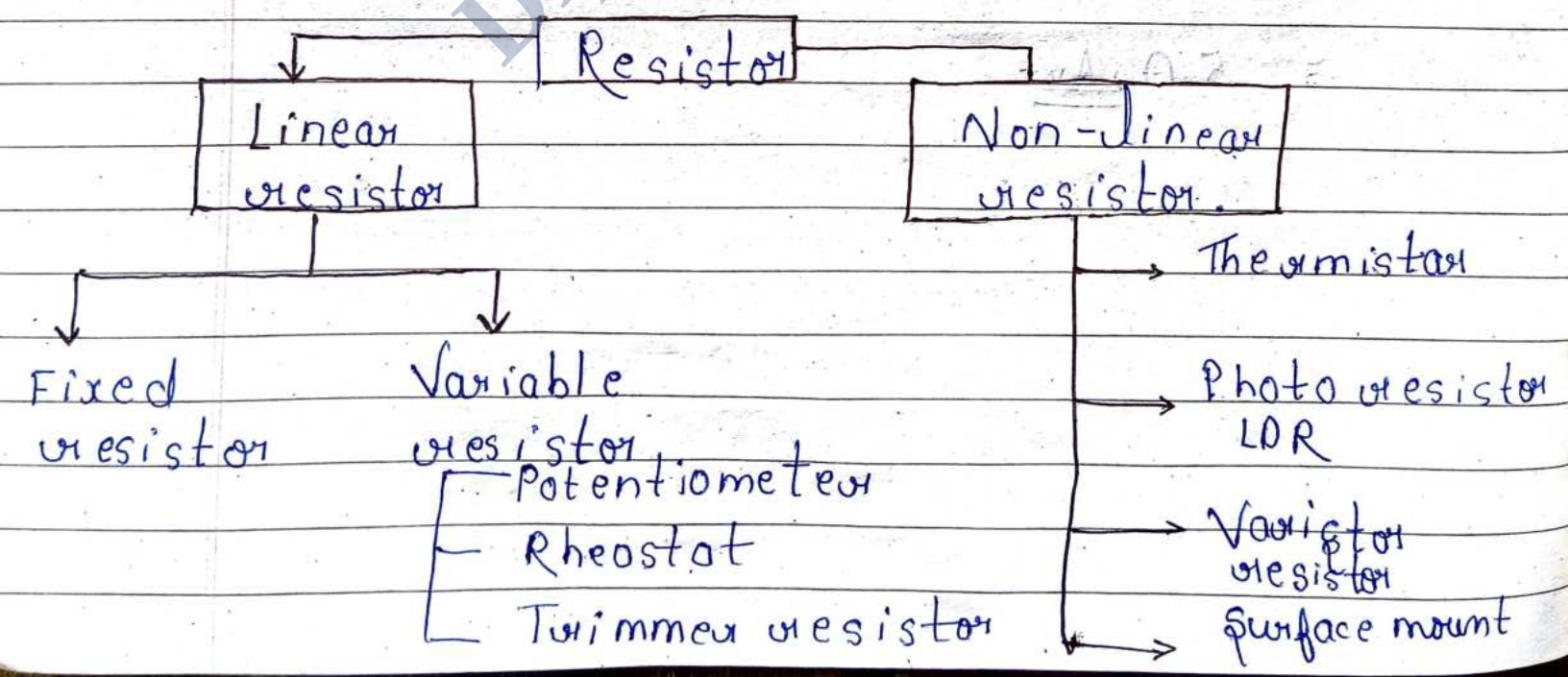
2

$= 5\,A$ Ans

* What is a Resistor ?

→ A resistor is a device that obstructs the flow of current. It is a passive two-terminal device which is used to regulate the flow of electric current. Glass, Mica, Wood, Rubber, etc. are examples of resistive materials. The unit of resistance is ohm (Ω) where $1\Omega = 1V/1A$. In electronic circuits, resistors are used to adjust signal levels, reduce current flow, bias active element, terminate transmission lines, divide voltage etc.

* Types of Resistor :-



Fixed resistor
- Thick film resistor
- carbon composition resistor
- Wire-wound resistor
- Thin film resistor
- Metal film resistor
  - Fusible resistor
  - cerment film resistor
  - Metal oxide resistor

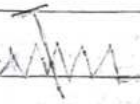
There are numerous types of resistors that are available and can be used in electronic circuits. These different types of resistors have different properties depending upon their manufacture and construction. There are different types of resistors available for various application. The resistors are available in different shapes, size and materials. Normally resistors can be classified into two types namely linear resistor and non-linear resistor.

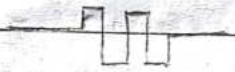
* Symbol of resistor :—

:— Resistor NEMA system.

 :- Attenuator

 :- Not burnable resistor

 :- Present resistor

 :- Not reactive resistor

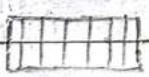
 :- Memristor

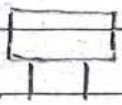
 :- Protective resistor

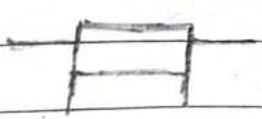
 :- Resistor IEC system.

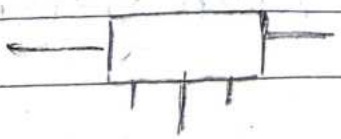
 :- Non reactive Resistor.

 :- Impendance

 :- Heating element.

 :- Resistor with fixed sockets.

 :- Shunt resistor

 :- Resistor with sockets of current.

 :- Resistor array.

The above image represents different kinds of symbols of different combinations of resistors.

There are two basic types of resistors.

- Linear resistor
- Non-linear resistor

* Linear Resistor :-

Those resistors, which values change with the applied voltage and temp, are called linear resistors. In other words, ~~called~~ a resistor, which current value is directly proportional to the applied voltage is known as linear resistor.

Generally, there are two types of resistor which have linear properties.

- Fixed resistor
- Variable resistor

* Fixed resistor :- As the name tells everything, fixed resistors

which has a specific value and we can't change the value of fixed resistors.

Types of fixed resistors :—

- Carbon Composition resistor
- Wire wound resistor
- Thin film resistor
- Thick film resistor

* Carbon Composition Resistors :—

A typical fixed resistor is made from the mixture of granulated or ~~powdered~~ powdered carbon or graphite, insulation material determine the actual resistance of the resistor. The insulating powder made in the shape of rods and there are two metal caps on the both ends of the rod.

There are two conductor wires on the both ends of the resistor for easy connecting in the circuit via soldering. A plastic coat covers the rods with different color codes (printed) which denote the

resistance value. They are available in 1 ohm to 25 mega ohms and in power rating from 1/4 watt to up to 5 watts.

* Wire Wound Resistors

→ Wire wound resistor is made from the insulating core or rod by wrapping around a resistive wire. The resistance wire is generally Tungsten, magnasium, Nicrome or nickel or nickel chromium alloy and the insulating core is made of porcelain Bakelite, press bond paper or ceramic clay material.

The manganin wire wound resistors are very costly and used with the sensitive test equipment e.g. wheatstone bridge etc. They are available in the range of 2 watts up to 100 watt power rating or more. The ohmic value of these types of resistors is 1 ohm up to 200 K ohms or more and can be operated safely up to 350°C.

In addition, the power rating of a high power wire wound resistor is 500 watts and the available resistance value of these resistors are 0.1 ohm 100K ohms.

* Thin Film Resistors :—

Basically, all thin film resistors are made of from high grid ceramic rod and a sensitive material. A very thin conducting material layer overlaid on insulating rod, plate or tube which is made from high quality ceramic material or glass. There are two further types of thin film resistors.

- Carbon film resistors
- Metal film resistors.

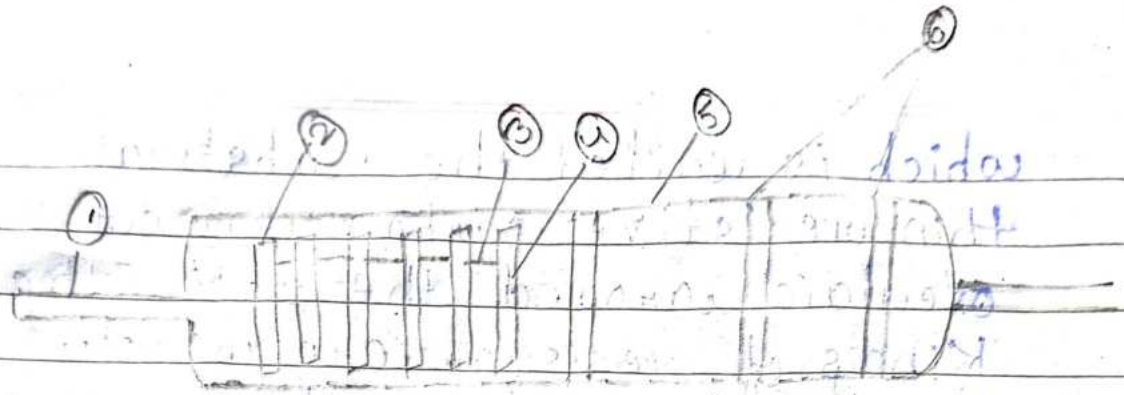
* Carbon Film Resistors :—

→ Carbon film resistor contains on an insulating material rod or core made of high grade ceramic material

which is called the substrate. A very thin resistive carbon layer or film overlaid around the rod. These kinds of resistor are widely used in electronic circuits because of negligible noise and wide operating range and the stability as operating compared to solid carbon resistors.

* Metal Film Resistor :-

→ Metal film resistor are same in construction like carbon film resistors, but the main difference is that there is metal (or a mixture of the metal oxides, Nickel chromium or mixture of metals and glass which is called metal glaze which is used as resistive film) instead of carbon. Metal film resistors are very tiny, cheap and reliable in operation. Their temperature coefficient is very low (± 2ppm/°c) and used where stability and low noise level is important.



① Leads ② End cap ③ Ceramic
④ Metal film ⑤ Empty coating
⑥ Color Bands.

→ Metal film resistors construction and internal parts of metal film resistor.

* Thick Film Resistors :—

→ The production method of thick film resistors is some like thin film resistors but the difference is that there is a thick film instead of a thin film or layer of resistive material around. That's why it is called thick film resistors. There are two additional types of thick film resistors.

- Metal oxide resistors
- Fusible resistors.

* Variable Resistors :-

As the name indicates, those resistors which values can be changed through a dial, Knob, and screws or manually by a proper method. In these types of resistors there is a sliding arm, which is connected to the shaft and the value of resistance can be changed by rotating the arm.

They are used in the radio receiver for volume control and tone control resistance.

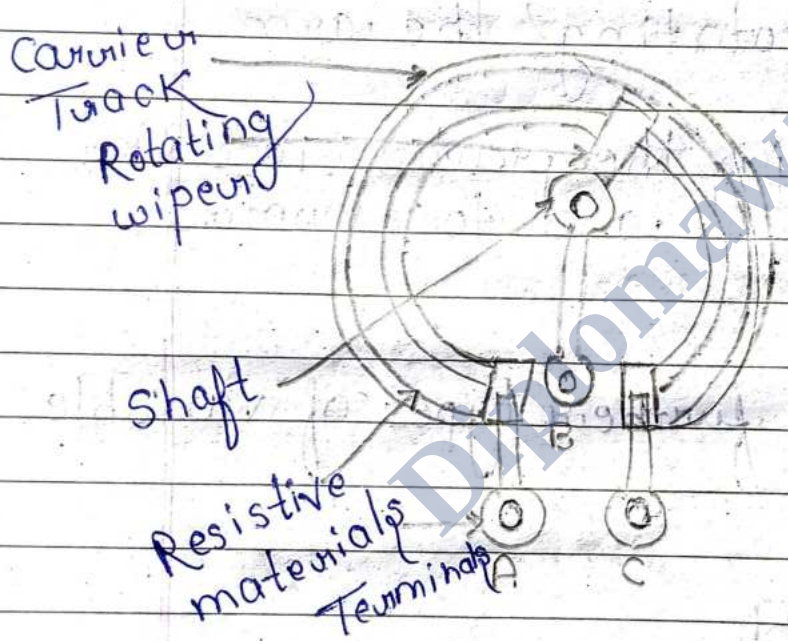
* Following are the further types of Variable Resistors.

- Potentiometer
- Rheostats
- Trimmers

* Potentiometer :-

Potentiometer is a three terminal device which is used for controlling the level

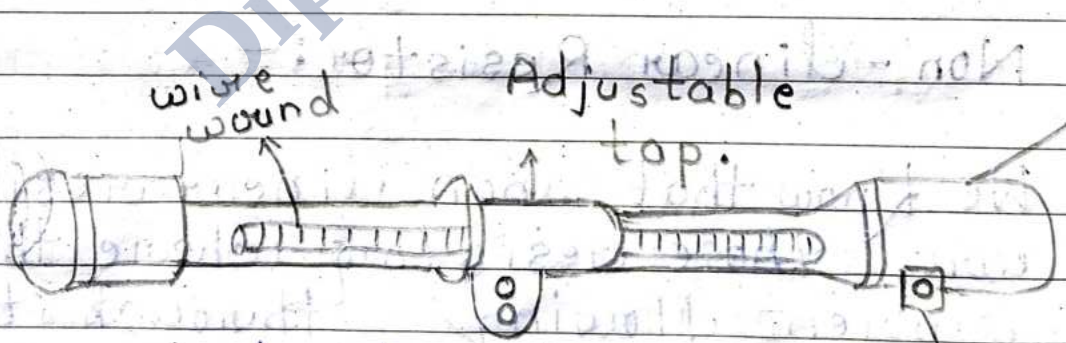
of voltage in the circuit. The resistance between two external terminals is constant while the third terminal is connected with moving contact (wiper) which is variable. The value of resistance can be changed by rotating the wiper which is variable. The value of resistance can be changed by rotating wiper which is connected to the control shaft.



This way, Potentiometer can be used as a voltage divider and these resistors are called variable composition resistors. They are available upto 10 Mega ohms.

* Rheostats :—

→ Rheostats are a two or three terminal device which is used for the currents limiting purpose by hand or manual operation. Rheostats are also known as tapped resistors or variable wire wound resistors.
To make a rheostats, they wire wind the Nichrome resistance around a ceramic core and then assembled in a protective shell. A metal band is wrapped around the resistor element and it can be used as a Potentiometer or Rheostats.



Construction of Rheostat

Variable wire wound resistors are available in the range of 1 ohm up to 150 ohms. The available power rating of these

resistors is 3 to 200 watts. While the most used Rheostats according to power rating is between 5 to 50 watts.

* Trimmers :-

There is an additional screw with potentiometer or variable resistors for better efficiency and operation and they are known as Trimmers. The value of resistance can be changed by changing the position of screw to rotate by a small screw driver.

* Non-linear Resistor :-

We know that, non linear resistors are those resistors where the current flowing through it does not change according to ohm's law but, changes with change in temp or applied voltage.

In addition, if the flowing current through a resistor changes with

change in body temp, then these kinds of resistors are called Thermistors.
If the flowing current through a resistor change with the applied voltages, then it is called a varistors or VDR (voltage dependent Resistors).

Flowing are the additional types of Non-linear resistors.

- Thermistors
- Varisters (VDR)
- Photo Resistor or Photo conductive cell or LDR.

* Problems on diode :-

Q. An AC voltage of peak value of 20V is connected in series with a silicon diode and load resistance of 500 ohm. If the forward resistance of diode is 10Ω. Then find out
(i) Peak current through diode
(ii) Peak output voltage (consider diode is assume to be ideal)

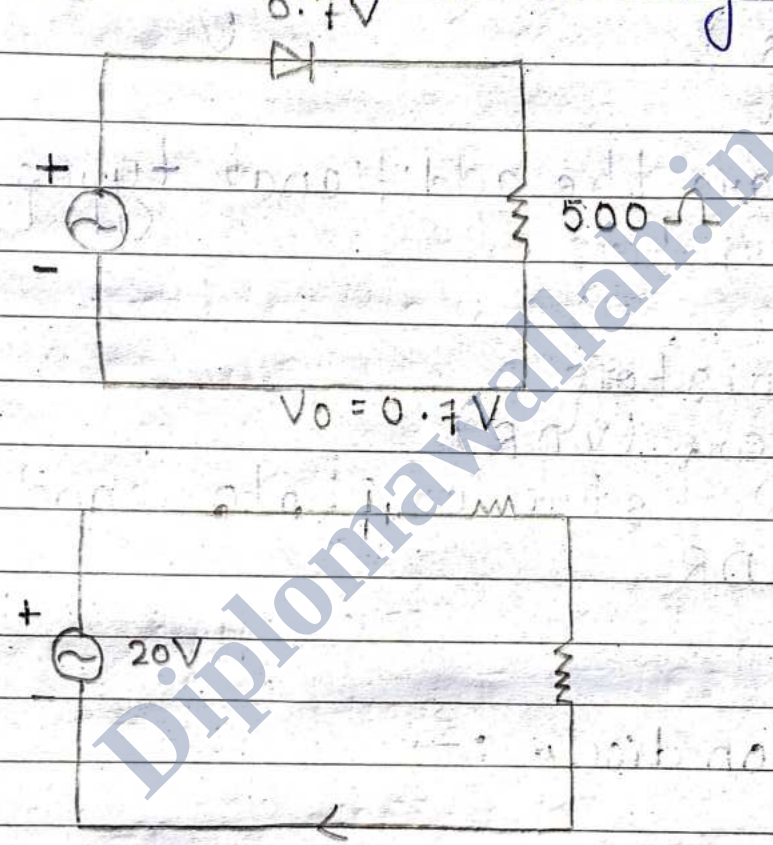
→ Given,

Pick out voltage = 20V

(Load resistance) $R_L = 500\ \Omega$

(forward resistance) $R_F = 10\ \Omega$

Potential Barrier voltage (V_0) = 0.7V



(i) The peak current through diode will occur at the instant when the input voltage reaches positive peak i.e $V_{in} = V_F = 20V$

Net circuit voltage $= V_F - V_0$

$= 20 - 0.7$

$= 19.3\ V$

Resistance equivalent (R_{eq}) $= R_L + R_F$
$= (500 + 10)\Omega$
$= 510\Omega$

Peak current (I) $= \frac{V}{R}$

$= \frac{19.3}{510 \times 10}$

$= \frac{193}{5100}$

$= 0.0378$ Amp

$= 0.0378 \times 10^{-3}$

$= 37.8$ m amp.

(11) Peak output voltage $= (I_F)$ Peak $\times R_L$
$= 37.8\ mA \times 500\Omega$
$= 0.0378A \times 500\Omega$
$= 18.9V$

For ideal diode

$V_0 = 0V$

$\gamma_F = 0\Omega$

$V_F = (I_F)$ Peak $\times R_L$

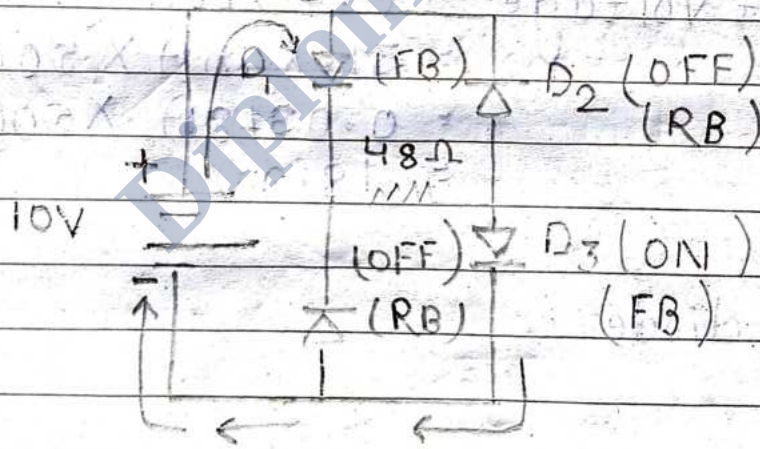
$(I_F) = \frac{V_F}{R_L}$

$= \frac{20V}{500\Omega}$

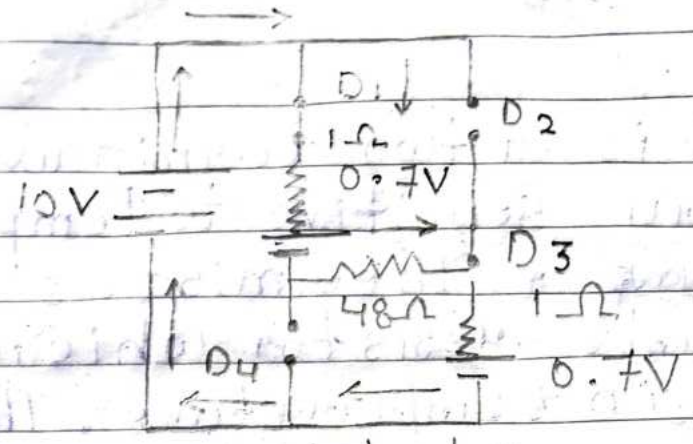
$= 40mA$

Peak output voltage $= (I_F)_{peak} \times R_L$
$= 40mA \times 500\Omega$
$= 20V$

Q. Calculate the current through 48Ω resistor in the circuit shown below. Assume the diode to be of silicon and forward resistance of each diode is 1 ohm.



→ Diode D_1 and D_3 are in forward bias while D_2 and D_4 are in reversed biad. Replacing diodes D_1 & D_3 by their equivalent circuits and making the branches containing diode D_2 and D_4 open. (The potential barrier is 0.7 V)



Equivalent circuit.

Net circuit voltage = 10 − 0.7 − 0.7
= 8.6 V

Total circuit resistance = $R_L + R_F + R_F$
= 48 + 1 + 1
= 50 Ω

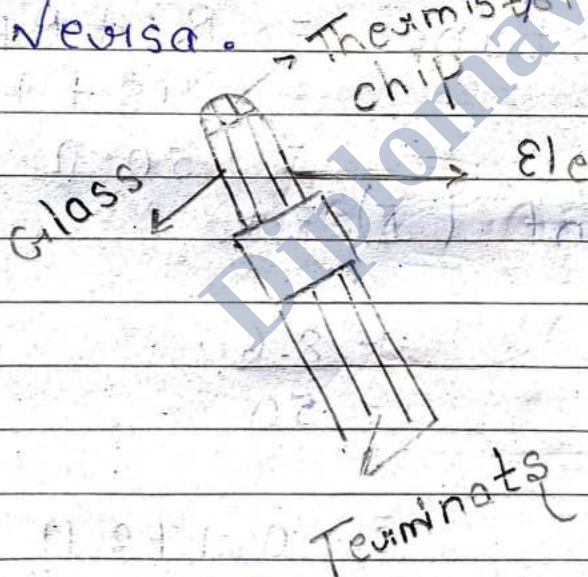
Circuit current (I) = $\frac{V}{R}$

= $\frac{8.6}{50}$

= 0.172 A
= 1.72 mA Ans-

- Thermistors :—

→ Thermistors is a two terminal device which is very sensitive to temperature In other words, Thermistors is a type of variable resistor which notices the change in temperature. Thermistors are made from the cobalt, Nickel, Strontium and the metal oxides of Manganese. The Resistance of a Thermistor is inversly proportional to the temp, i.e. resistance increases the when temp decrease and vice versa.



Construction of Thermistor

* Types of Thermistors :—

(i) Beads Thermistor

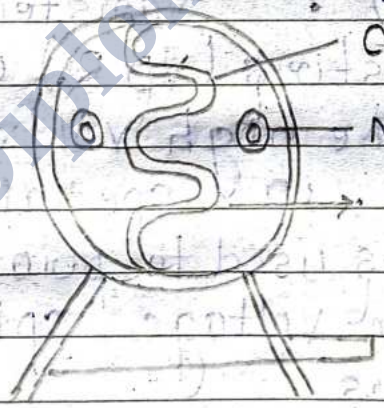
(ii) Disc Thermistor
(iii) Glass Prob Thermistor
(iv) Special Prob Assembly Thermistor
(v) Washer Thermistor.
(vi) Special mounded bead ring Thermistor

It means, Thermistors has a negative temperature cofficient (NTC) but there is also a PTC (Positive Temperature cofficient) which is made from pid Barium Titanate semi conductor materials and their resistance increases when increases in temperature.

- Varistors (VDR) :— Varistors are voltage dependent Resistors (VDR) which is used to eliminate the high voltage transients. In other words, a special type of variable resistors used to protect circuits from destructive voltage spikes is called Varistors.
When voltage increases across a connected sensitive device or system, then it reduces the level of voltage to a secure level i.e it changes the level of voltages.

- Photo Resistors or Photo conductive cell or LDR (Light dependent Resistors) :—

Photo Resistor or LDR is a resistor which terminal value of resistance changes with light intensity. In other words, those resistors, which resistance values changes with the falling light on their surface is called photo resistors or Photo conductive cell or LDR. The material which is used to make these kinds of resistors is called photo conductors, e.g. cadmium sulfide, lead sulfide etc.



When light fall on the photoconductive cells, then there is an increase in the free carriers due to light energy, which reduce the resistance of semiconductor material. It means photo resistors have a negative temp coefficient.

* SMD (Surface Mount Technology) Resistors :-

SMD resistor with color coding method which we have already discussed.

Application of Resistors :-

→ Practically, both types of resistors (Fixed and Variable) are generally used for the following purposes.

Resistors are used :-

- For current control and limiting
- To change electrical energy in the form of heat energy.
- As a shunt in Ampere meters.
- As a multiplier in voltmeter
- To control temp
- To control voltage or Drop.
- For protection purpose, e.g. fusible Resistors.
- In laboratories
- In home electrical appliances like heater, iron, immersion rod etc.

- Widely used in the electronic industries.

The Kinds of capacitors accessible reach from a little sensitive managing capacitor utilizing an oscillator or radio circuits. It is up to enormous force metal can type capacitors that in use within high voltage power amendment and smoothing circuits.

Following is the classification of the capacitor types, According to structure

1. Fixed capacitors
2. Variable capacitors
3. Trimmer capacitors

Following is the classification of the capacitor types, According to polarization:

1. Polarized
2. Unpolarized.

A polarized capacitor is a significant part of the electronic circuit and frequently

named as an electrolytic capacitor. These capacitors are in use to accomplish high capacitive density.

Unpolarized capacitors are favoured over capacitors with full energy. Since it doesn't get annihilates by invert voltage and can be in use in pure AC circuits. They additionally discover applications in DC circuits as they don't have positive and negative closures. The recurrence of the unpolarized capacitor is high and the spillage current is dow.

* Types of capacitors :—

→ Capacitors are ordered into 2 mechanical gatherings. Fixed capacitors comprising of fixed capacitance worth. And variable capacitance with variable capacitance esteem. Underneath are a short portrayal of different capacitor type and their properties.

1. Ceramic capacitors
2. Film capacitors
3. Power film capacitor
4. Electrolytic capacitor

5. Ceramic capacitor
6. Film capacitor
7. Paper capacitor
8. Electrolytic capacitor

- Ceramic Capacitors :— A ceramic capacitor is one of the most normally in use capacitors. The material in use within this capacitor type is dielectric. Additionally, ceramic capacitors are a non-polar gadget which implies that they could be in use toward any path in the circuit.

Types of ceramic capacitors :—

Contingent upon the accessibility of the capacitor, ceramic capacitors are ordered into three gatherings:

- Leaded plate ceramic capacitors
- Surface amount multi-layered ceramic capacitors.
- Microwave exposed lead-less plate ceramic capacitors.

* Application of ceramic capacitors :-

1. Ceramic capacitors are useful in printed circuit sheets that are in use in high density applications.

2. Their non-extremity makes them reasonable for general use.

3. They discover applications in DC engines as they are in use for diminishing the RF noise.

4. Ceramic capacitors are useful in transmitter stations where full circuits are in use.

Film Capacitor :-

→ Film capacitors are a polymer film, plastic film, or film dielectric. The benefit of film capacitors is that they are modest and accompained boundless time span of usability. The film capacitor utilizes a slight dielectric material

with the opposite side of the capacitor metalized contingent upon the application, the film capacitor is folded into slender movies. The overall voltage scope of these capacitors is from 50V to 2KV.

Types of Film capacitors :-

Depending on the dielectric material used and applications, given below is the classification of the film capacitors :

1. Heavy duty snubber capacitor
2. SMD style capacitor
3. Axial style capacitor
4. Radial style capacitor

* Application of film capacitors :-

1. These capacitors are in use as well being capacitors and in electromagnetic impedance.

2. Power film capacitors discover applications in force hardware.

2. Power film capacitors discover applications in ford hardware.

3. These capacitors are in use for shielding the gadgets from unexpected voltage spikes.

4. Film capacitors are in use for improving the power factor of the gadget.

* Power Film Capacitors :-

→ Development methods and materials that are in use power film capacitors are like that of standard film capacitors. Poly propylene film is in use as a dielectric in a capacitor.

Electrolytic capacitors :-

In an electrolytic capacitor, a metallic anod covered with a oxidized layer. It is in use as dielectric.

* Applications of electrolytic capacitor :-

(1) Electrolytic capacitor are in use when

there is a prerequisitible for enormous capacitance.

2. They are useful as shifting gadgets that bring down the wave voltage.

3. They are useful in sound speakers to decrease the electrical noise that is induced by the fundamental flexibility.

4. Electrolytic capacitors are useful in smoothing the info and yield signals in a DC signal that has a powerless AC segment.

* Paper Capacitor :-

→ Paper capacitor is a fixed capacitor in which paper is in use as the dielectric material. The measure of electric charge put away by the paper capacitor is fixed. It comprises of two metallic plates and paper which is utilized as a dielectric material is put between these plates.

* Applications of paper capacitor :—

1. These capacitors are in use for noise sifting, coupling and decoupling frameworks.

2. They are additionally in use for impeding the DC flgs so AC signals are gone through.

3. Sensors, for example, stickiness sensors fuel level sensors, and so on utilized paper capacitors.

4. Paper capacitors are utilized in sound frameworks of ~~yehi~~ vehicles as they give additional capacity to the speakers.

* Different type of Inductors :—

The different types of inductors include the following:

(i) Iron core Inductor
(ii) Coupled Inductor
(iii) Air core Inductor
(iv) Iron powder Inductor
(v) Variable Inductor
(vi) Ferrite core Inductor
(vii) Choke

* Iron Core Inductor :—

→ Iron core inductors are made of iron and are normally used in high power inductors, but they are limited in high frequency capacity. They are limited used in places where low space inductors are required because being low space inductors, they have high inductance value when compared to air core conductors. Also, there is a significant energy loss in the process. These inductors are widely used in audio equipment.

* Air Core Inductor :—

Air core Inductors are hollow and are normally used in applications where the

level of inductance requirement is very low. The fact that no core is used ensures there are no losses within the core and the coil is supported by the air.
These types of inductors are effective in high frequency settings. The core of these conductors is made up of plastic or ceramic and so they are also known as ceramic conductors.

* Iron Powder Inductor :-

An Iron powder Inductor is an inductor that uses compressed iron powder in its core. This core material makes it possible to create a magnetic field around the inductor so that when an electric current runs through it, energy is stored in the form of a magnetic field.

* Ferrite Core Inductor :-

Ferrite core inductor use a road or core made from a ferric material. The two main components of these inductors

are the ferrite core and the winding. The most common material used in ferrite core inductors is ferromagnetic material which increases the formation of a magnetic field thus providing a higher inductance value.

Ferrite core inductors are further classified into two types namely soft ferrites and hard ferrites.

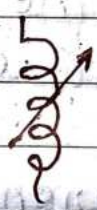
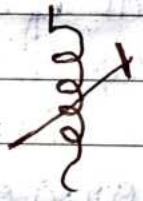
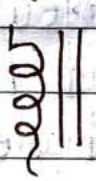
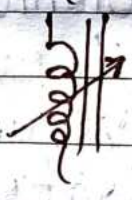
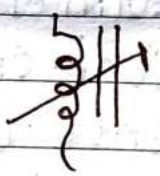
- Soft ferrite :— These are materials that have the cability to reverse their polarity without any external energy.
- Hcard ferrite :— These are permanent magnets that is their polarity will not change even when the magnetic field is removed.

* Choke :—

→ A choke inductor, more commonly called a 'choke', is an electrical component used chiefly for choking

off or blocking alternating current (AC) while allowing direct current (DC) to pass with relatively little resistance. This sort of inductor has a high impedance to AC signals, so it effectively filters or isolates them from circuits.

Chokes are most commonly used in electronic circuits for filtering and noise suppression as well as to separate AC and DC signals.

Inductor	Fixed	Variable	Pre-set	Shape
Air Core				
Iron Core				
Ferrite Core