# BASIC ELECTRONICS (26811)

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# TODAY'S TOPIC

## CHAPTER 1 SOLDERING AND COLOR CODE

5) Describe the active and passive components used in electronic circuits.
6) Mention the function of resistor, capacitor and inductor in electronic circuits.
7) Describe the procedure of determining the value of Capacitor & Resistor using numeric and color code.

# 1.1 Describe the active and passive components used in electronic circuits.

**Active component:-** Those devices or components which require an external source to operate in a circuit are called Active Components.

**For Example:** Diode, Transistor, SCR etc…

**Passive Components:-** Those devices or components which do not require an external source to operate in a circuit are called Passive Components.

**For Example:** Resistor, Capacitor, Inductor etc…

## 1.2 Mention the function of resistor, capacitor and inductor in electronic circuits.

**Resistor-** A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. The SI unit of resistor is Ohm (Ω).

### Types of Resistors

1) Carbon Composition Resistor
2) Carbon Film Resistors
3) Metal Film Resistors
4) Wire Wound Resistors

# Types of Resistors

**Capacitor -** A capacitor is defined as a passive component which is used for storing electrical energy.
The standard unit of capacitance is called the farad, which is abbreviated F.

## According to structure, capacitors are classified as:

1) Fixed Capacitors
2) Variable Capacitors

## The capacitors are classified into two types according to polarization:

1) Polarized
2) Unpolarized

# Capacitor Types

Paper

Polystyrene

Bipolar

Electrolytic

Polycarbonate

Polyester

Mylar

Silver Mica

Ceramic

Tantalum Electrolyte

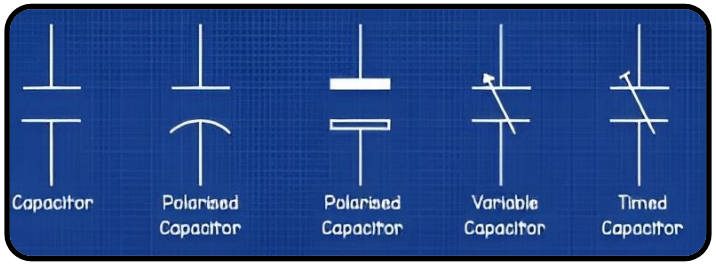
Feed Through

Trimmer

Variable

## Types of Capacitors

1) Ceramic Capacitors
2) Film Capacitors
3) Power Film Capacitors
4) Electrolytic Capacitors
5) Ceramic capacitors
6) Film capacitors
7) Paper Capacitors
8) Electrolytic capacitors



## 1.6.1 Describe the operation and construction of a electrolytic, non-electrolytic and air spaced capacitiors

**Electrolytic capacitor-** An electrolytic capacitor is a type of capacitor that uses an electrolyte to produce a higher capacitance than other types of capacitors. The electrolyte is a fluid or gel with a large number of ions. The high capacitive reactance of electrolytic capacitors has advantages and disadvantages.

**Characteristics of electrolytic capacitor-**

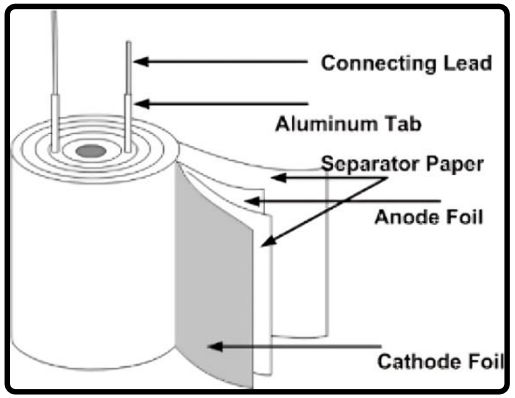
1. It is a type of polarized capacitor.
2. Its plates are marked as positive and negative electrodes.
3. It is commonly used in DC.
4. Capacitance values are usually one microfarad or more.
5. They are very small in size.

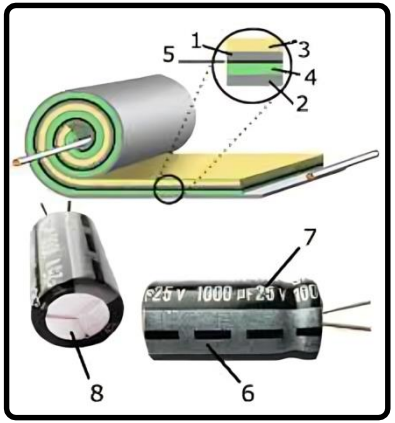
**Structure-** The electrolytic capacitor construction involves two thin layers of aluminum foil – the plain foil and the etched foil. These two foils are separated by an electrolyte. To set up the polarity of two foils, they are anodized by chemically growing a thin layer of aluminum oxide to form the anode and distinguishes itself from the cathode. In the process of electrolytic capacitor construction, the cathode and the anodized anode are formed, which is separated by an electrolyte (paper soaked with electrolyte).

During standard operation, the anode is held at positive concerning the cathode, hence cathode is indicated with negative (-) sign on the capacitor's body. As aluminum is a polarized device, applying a reverse voltage on these terminals would produce the insulation in the capacitor, damaging the capacitor.

The unique property of an aluminum capacitor is the self-healing process of a damaged capacitor. During the reverse voltage, the oxide layer gets removed from the foil, yet allowing the current to pass from one foil to another.

## Structure-


Connecting Lead
Aluminum Tab
Separator Paper
Anode Foil
Cathode Foil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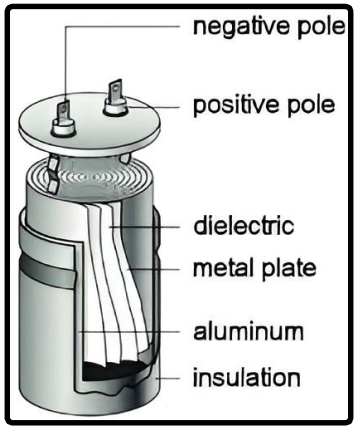
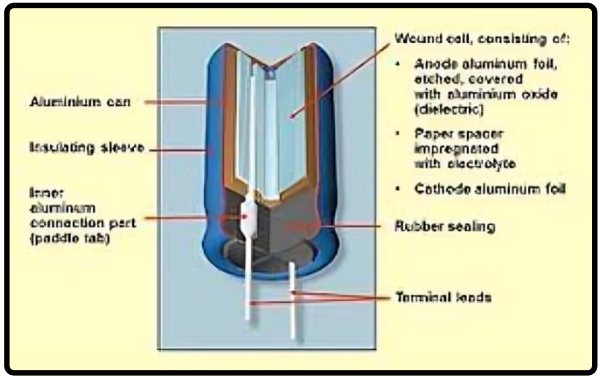

negative pole
positive pole
dielectric
metal plate
aluminum
insulation


Aluminium can
Insulating sleeve
Inner aluminum connection part (paddle tab)
Wound coil, consisting of:
Anode aluminum foil, etched, covered with aluminium oxide (dielectric)
Paper spacer impregnated with electrolyte
Cathode aluminum foil
Rubber sealing
Terminal leads

**The Function and Working principle-** Because the electrolytic capacitor is built asymmetrically, it contains polarized components. This structure owes to its higher voltage functioning, in which one side gets more power than the other. It features a metal or aluminum anode with an oxidized cover layer that acts as a dielectric and serves as the capacitor's positive electrode. This side gets the majority of the input voltage.

The cathode, which includes aluminum foil and a liquid electrolyte, serves as the negative electrode. This liquid is typically made up of water and sodium borate or boric acid. A few sugars are also added to avoid evaporation. Aluminum oxide is responsible for the polarity of electrolytic capacitors. It is held in place by the electric field. When direct current (DC) voltage is applied to an electrolytic capacitor, the correct polarity must be present. This necessitates connecting the positive lead and positive terminal, as well as the negative lead and negative terminal. If this is not done correctly, the capacitor will be ruined.

**Types of Electrolytic Capacitors -**

Electrolytic capacitors are mainly of two types. Namely-

1. Wet type ,
2. Dry type .

**Wet type -** Such capacitors have one electrode of aluminum and the other of an electrolytic solution, usually a combination of ammonia, boric acid and water.

**Dry type -** Both plates of this type of capacitor are made of long strips of aluminum and are separated by special paper impregnated with electrolyte. They are then rolled together and tied firmly.

**Non-Electrolytic Capacitors -** Capacitors which are not polarized and do not have positive and negative polarity marked, are called non-electrolytic capacitors.

A non-conductive medium such as paper, mica, ceramic or polyester is placed between two metal sheets.

Non-electrolytic capacitors are made by enclosing them in plastic or metal capsules. It is the non-conducting medium used in it that acts as its dielectric and

The name of the capacitor is according to the name of this non-conductive medium. For example - paper capacitor, ceramic capacitor, mica capacitor, polyester capacitor, striloflex capacitor etc. The value of such * capacitors is limited to a few hundred picofarads.

**Paper Capacitor-** This is a widely used capacitor. It uses paper as a dielectric, for which it is called a paper capacitor.
Paper capacitors are used in both high and low voltage circuits. It is commonly used as a coupling and bypass capacitor in power supplies and amplifiers.

**Mica Capacitor-** Mica is used as a dielectric in this type of capacitor. Usually their value and voltage rating are written on them. But in some cases, they have a color code like a register, from which their value has to be determined.
It is commonly used in high frequency receiver and transmitter RF circuits.

**Ceramic Capacitor**-Ceramic is used as a dielectric in ceramic capacitors. The dielectric of ceramics is very high. Therefore, the stability of this capacitor is good despite the changes in temperature and voltage. Their values usually range from 1 picofarad to $10^5$ picofarad and their working voltage is limited to 500 volts.
This type of capacitor is particularly useful for short wave circuits. It is in tuning circuit, bypass circuit and couplingUsed to do.

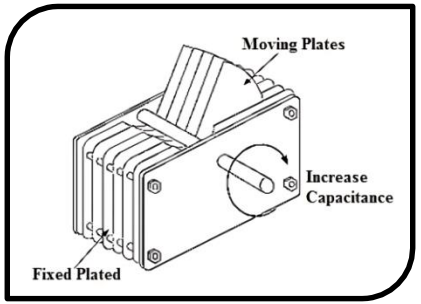
**Polyester Capacitor-** Polyester foil is used in this type of capacitor. Its exterior is covered with a special type of insulation and waterproof lacquer. Their values usually range from 10 picofarad to 106 picofarad and their working voltage is limited to 500 volts.
As this type of capacitor is stable, moisture resistant, small in size and cheap in price, it is used in various parts of the circuit. But more commonly used in coupling and bypass circuits.

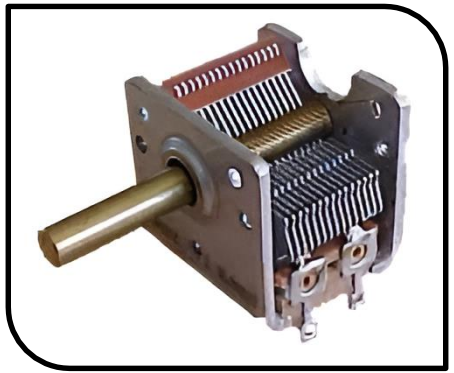
**Striloflex Capacitor-** Striloflex is a small transparent capacitor. Its loss is very low and frequency characteristic is very high. Their working voltage is limited to 125 volts to 250 volts. Their value is written on the working voltage and tolerance.
This type of capacitor is commonly used in tuning oscillators and frequency determining circuits.

**Mica Tuned Capacitor-**This type of capacitor is known as trimmer capacitor. Their value is very low. Typically limited to 4 picofarads to 70 picofarads. Suppose the value of the capacitor is variable. But with their help very little value variation is possible. In the Revore tuning circuit It is used.

**Air Spaced Capacitor-** Air spaced capacitor is a type of non-electrolytic capacitor. A capacitor uses air as a dielectric between the two plates. A capacitor in which air is used as a dielectric between the two plates is called an air-spaced capacitor. The capacitance value of such capacitor is very low i.e. limited to 0.01µf. Air tuned capacitors are used to tune the radio to the correct station.

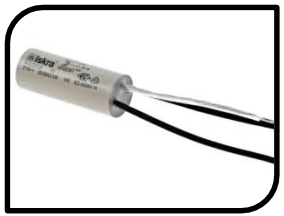
## Construction and properties of Air  Spaced capacitors -

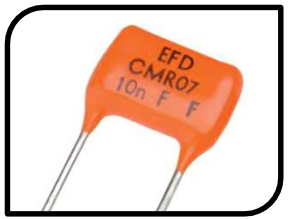


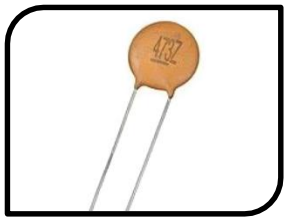



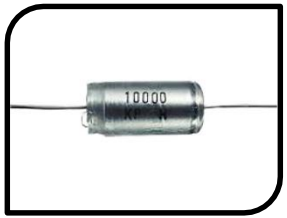
An adjustable capacitor like an air capacitor consists of a series of semicircular, rotating aluminum plates that are located on top of a central shaft arranged between a set of equally spaced fixed aluminum plates. The capacitor has a borehole in the center for passing a control rod. To control the rod, alternating discs are connected so as to pass freely through the other discs, which means that the set of discs is effectively divided into two groups that together form the two pole plate regions of the capacitor.

# All type of Non-Electrolytic Capacitors






## 1.7 Describe the procedure of determining the value of Capacitor & Resistor using numeric and color code.

### 1.7.1 Describe the procedure of determining the value of Capacitor & Resistor using numeric and color code.

**Write the value of the register in numeric format -** The value of the resistor can be determined from the number written on the resistor or from the manufacturing data. In this case Ohmke Ω. Kiloohm is expressed as k Ω and megaohm as M Ω etc. But now R or K instead of Ω mean Ohm and kiloohm, megaohm etc values are only k, M etc. instead of kΩ, MΩ. Previously, the value of a register was written directly as a whole number or decimal. Currently, this writing style changes. The use of decimals has been abandoned.

**The table below shows the values of some registers in the current writing system-**

| Resistance | Pre-writing method | Currently writing method |
|---|---|---|
| 4.7 kiloohms | 4.7KΩ | 4k7 |
| 2.6 megaohms | 2.6MΩ | 2M6 |
| 5.5 ohms | 5.5 Ω | 5.5R or 5.5E |
| 0.5 ohms | 0.5 Ω | 0.5R or 0.5E |
| 1.0 ohms | 1.0 Ω | 1.0R or 1.0E |
| 56 ohms | 56 Ω | 56R or 56E |
| 47 kiloohms | 47KΩ | 47k |

**Color Code Resistor-** Small resistors or capacitors are marked with rings of different colors to indicate their values. These symbols are called color codes or color bands. And when the value of a resistor is expressed by a color code, it is called a color coded resistor. Since it is not possible to write their values on small registers, their values are expressed in the color code system.

The resistor is usually coated in brown or some other light color. On this coating, three color rings or bands (A, B, C) are given at a little distance from one side of the resistor. A little more than these three colors, another ring of brown, red, gold or silver color is given on the other side of the resistor. This is the fourth band (D) of the resistor and is used to determine the tolerance of the resistor. And if there is no color in the fourth band, then the fourth band is said to have no color or no color.

**Its value can be determined using the following formula-**

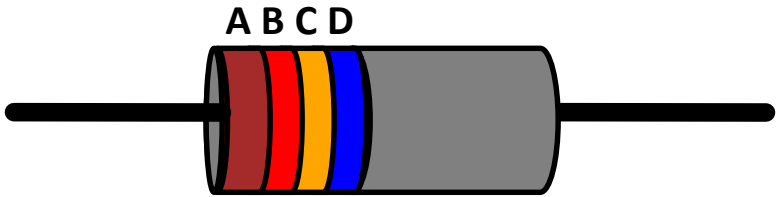



**Figure:-Color code resistor**

**The formula is as follows:**

$R=AB \times 10^{C}$ ohms

Here, R = Resistance (Ohm)

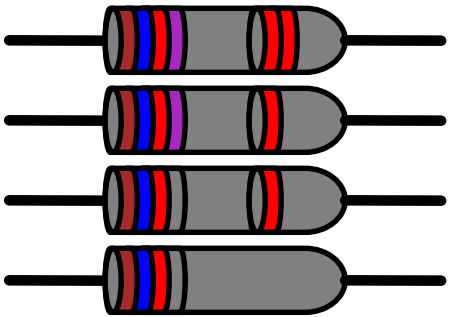
A = 1st digit, fixed digit value for 1st band color.

B = 2nd digit, fixed digit value for 2nd band color.

C = Power of 10, fixed numerical value for 3rd band color.

D = Tolerance, the numerical value specified for the color of the fourth band.

**Color code register is the name and value of the colors used in the register-**



# Thank You