Electronics is a subject which has all its base in the physics but highly application oriented subject and as a result looks like an engineering subject. Due to huge application of electronics in common day-to-day use, the subject becomes one of the most interesting subject in undergraduate program. Today you pick-up any fancy gadgets and that will have an electronic circuit within it. Now a days almost all electrical circuits involves ***active electronic components*** such as vacuum tubes, transistors, diodes and integrated circuits, and associated ***passive components***. So any circuit consisting primarily or exclusively of active semiconductors supplemented with passive elements; is described as an electronic circuit.

Active and Passive electronic components :

Active Components : Those devices or components which produce energy in the form of voltage or current are called as *active components*. For Example: Diodes, Transistors, SCR etc…

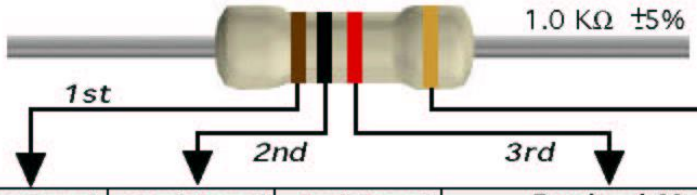
Passive Components : Those devices or components which store or consume energy in the form of voltage or current are known as passive components. For Example: Resistor, Capacitor, Inductor etc…

Resisters : A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. Resistors may have fixed resistances or variable resistances. The *current through a resistor is in direct proportion to the voltage* across the resistor's terminals. This relationship is represented by Ohm's law: I = V\R where, I is the current through the conductor in units of amperes, V is the potential difference measured across the conductor in units of volts, and R is the resistance of the conductor in units of ohms (symbol: Ω).

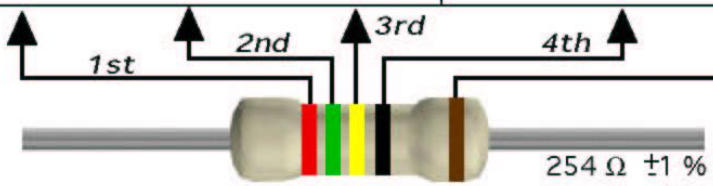
Color code of Resister : The axial lead carbon resistors measured by the color codes marked on them. Information such as resistance value, tolerance, temperature co-efficient measured by the color codes, and the amount of power (wattage) identified by the size. The color bands of the carbon resistors can be four, five or, six bands, for all the first two bands represent first two digits to measure their value in ohms. The third band of a four-banded resistor represents multiplier and the fourth band as tolerance. Whereas, the five and six color-banded resistors, the third band rather represents as third digit but the fourth and fifth bands represent as multiplier and tolerance respectively. Only the sixth band represents temperature co-efficient in a six-banded resistor.

RESISTOR COLOR CODE GUIDE

4- Band Code



Color	1st Band	2nd Band	3rd Band	Decimal Multiplier	Tolerance
Black	0	0	0	1	
Brown	1	1	1	10	± 1 %
Red	2	2	2	100	± 2 %
Orange	3	3	3	1K	
Yellow	4	4	4	10K	
Green	5	5	5	100K	
Blue	6	6	6	1M	
Violet	7	7	7	10M	
Gray	8	8	8		
White	9	9	9		
Gold				0.1	± 5 %
Silver				0.01	± 10 %
None					± 20 %



5- Band Code

Calculation

First Band Red ---------- 2
Second Band Black ---------- 0
Multiplier Band Yellow -- x10,000
Tolerance Band Silver -------10 %

The Gold or Silver band is always placed to the right.
The resistor value is read from the left to right.

If there is no tolerance band, then find the side that has a band closest to a lead and make that the first band.

Equation

20 x 10,000 = 200,000

1,000 = 1K

Resistor = 200 KΩ
with a ± 10 % Tolerance

Capacitor : A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e., insulator). The conductors can be thin films of metal, aluminum foil or disks, etc. The "nonconducting" dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, plastic film, air, paper, mica, etc. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates.

Capacitor types : Capacitors are available in many different forms. The type of internal dielectric, the structure of the plates and the device packaging all strongly affect the characteristics of the capacitor, and its applications. Capacitor's values available range from very low (picofarad range) to about 5 KF supercapacitors. Above 1 microfarad electrolytic capacitors are usually used because of their small size and low cost compared with other technologies, unless their relatively poor stability, life and **polarised nature** make them unsuitable. Very high capacity supercapacitors use a porous carbon-based electrode material.

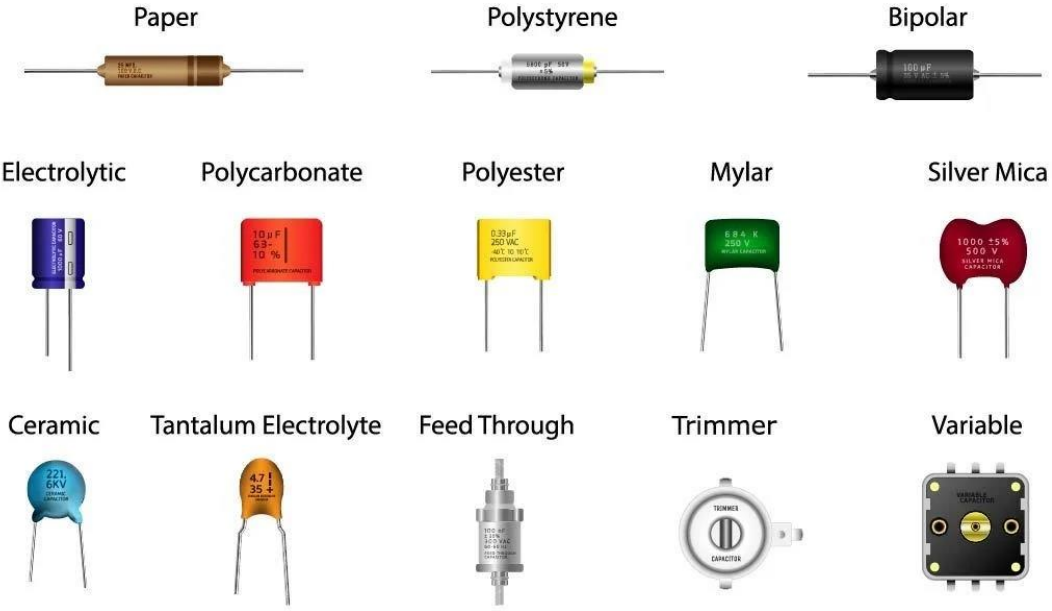
Electrolytic Capacitors: Must be used in circuit by taking care of the **polarity** !!

*A typical electrolytic capacitor showing polarity. The capacitor is of 150 µF capacity with 400 V. It is used generally when a **large value of capacitance** is required.*

*Solid electrolyte, resin-dipped 10 µF 35 V tantalum capacitors. The + sign indicates the positive lead. It is used generally when a **large value of capacitance along with precission** is required. More expensive !!*

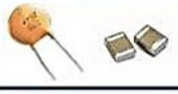
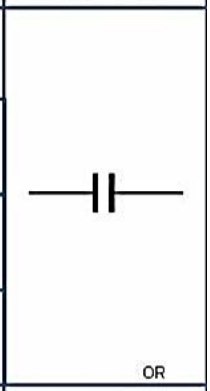
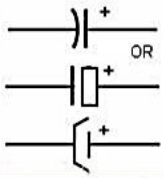
Lets see the different type of capacitors and its look !!

Capacitor Types

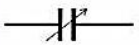
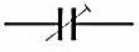


Lets understand the symbols used in the circuit for the capacitors !!

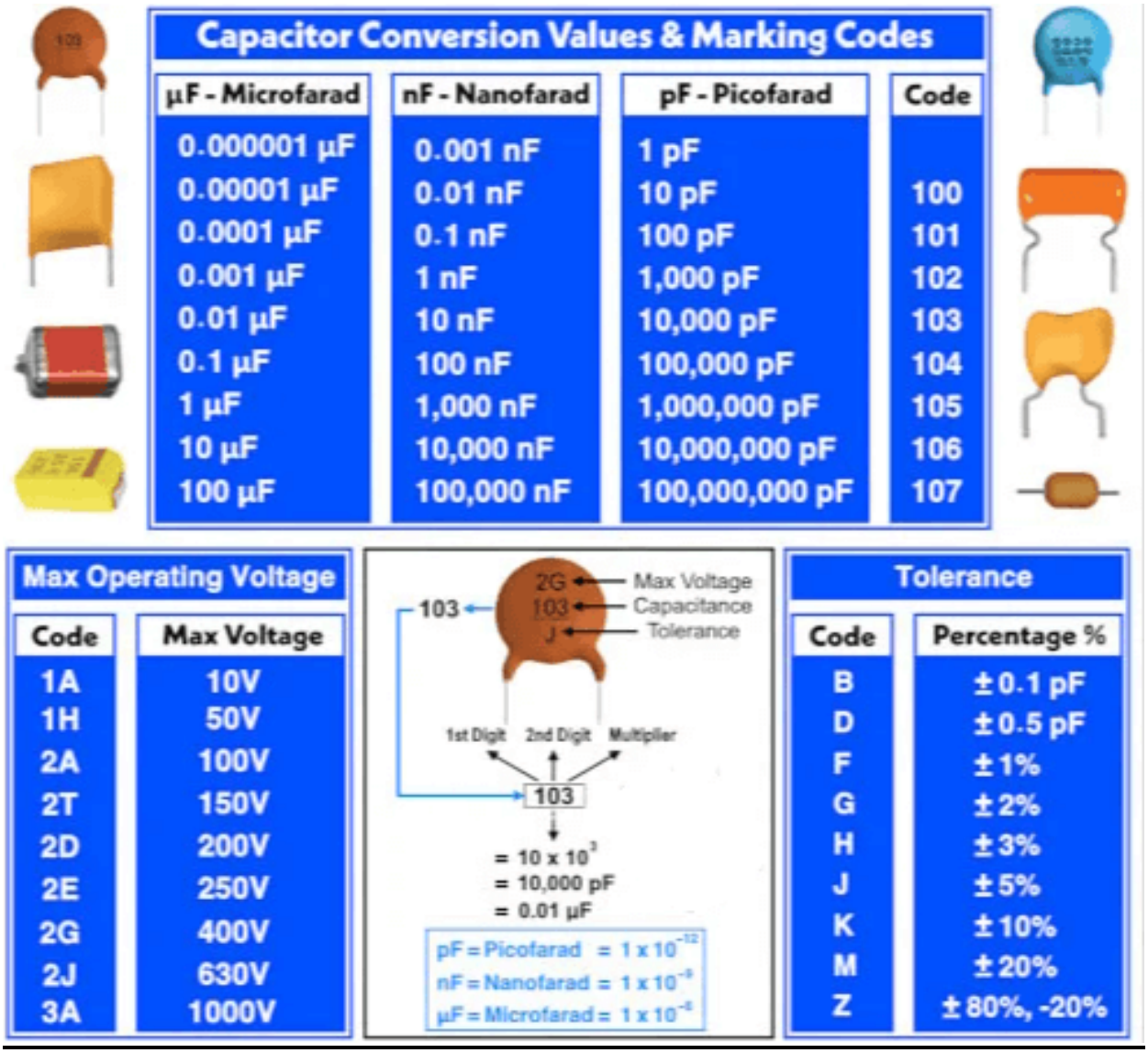
FIXED CAPACITOR

NAME	SHAPE	SYMBOL
(Ceramic Capacitor)		
(Polyster Capacitor)		
(Paper Capacitor)		
(Mica Capacitor)		OR
(Electrolute Capacitor)		 OR
(Tantalum Capacitor)		

Variable Capacitor

Name	Shape	Symbol
Varco (Variable Condensator)		
Trimmer		

Lets understand how to read the capacitance value !!



Capacitor Conversion Values & Marking Codes

µF - Microfarad	nF - Nanofarad	pF - Picofarad	Code
0.000001 µF	0.001 nF	1 pF	
0.00001 µF	0.01 nF	10 pF	100
0.0001 µF	0.1 nF	100 pF	101
0.001 µF	1 nF	1,000 pF	102
0.01 µF	10 nF	10,000 pF	103
0.1 µF	100 nF	100,000 pF	104
1 µF	1,000 nF	1,000,000 pF	105
10 µF	10,000 nF	10,000,000 pF	106
100 µF	100,000 nF	100,000,000 pF	107

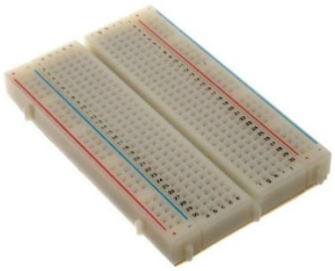
Max Operating Voltage

Code	Max Voltage
1A	10V
1H	50V
2A	100V
2T	150V
2D	200V
2E	250V
2G	400V
2J	630V
3A	1000V

Tolerance

Code	Percentage %
B	±0.1 pF
D	±0.5 pF
F	±1%
G	±2%
H	±3%
J	±5%
K	±10%
M	±20%
Z	+80%, -20%

Bread Board : A breadboard is usually a construction base for making prototype circuit in electronics testing. Because the solderless breadboard for electronics does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design.



The side column is connected with each other up to half way and you get similar two column in each side of bread board.

You can connect your +ve and -ve voltages to these columns for use. The middle holes are connected with each other in a single row. You can put your ICs in the middle while making circuits.

Transformer : Step down transformer reduces primary voltage to a considerable small secondary voltage. It is designed to reduce the voltage from the primary winding to the secondary winding. This kind of transformer "steps down" the voltage applied to it. As a step-down unit, the transformer converts high-voltage, low-current power into low-voltage, high-current power. The larger-gauge wire used in the secondary winding is necessary due to the increase in current. The primary winding, which doesn't have to conduct as much current, may be made of smaller-gauge wire.

Multimeter : A multimeter is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter would include basic features such as the ability to measure voltage, current, and resistance. Analog multimeters use a microammeter whose pointer moves over a scale calibrated for all the different measurements that can be made. Digital Multi-Meters (DMM) display the measured value in digital number the quantity being measured. Digital multimeters are now far more common than analog ones, but analog multimeters are still preferable in some cases, for example when monitoring a rapidly varying value.

Before measuring be sure the knob is directed to the right range of measurement. You can measure the following quantities in $\mathbf{3}\frac{1}{2}$ digit DT 830D Digital Multimeter.

Sl. No.	Measurement Parameter	Range	Remarks
1	DC Voltage	200 mV, 2000 mV, 20 V, 200 V, 1000 V	Common Probe for Voltage, Resistance, Current
2	AC Voltage	200 V, 750 V	"
3	Resistance	200 Ω, 2000 Ω, 20 kΩ, 200 kΩ, 2000 kΩ	"
4	Low Current	200 µA, 2000 µA, 20 mA, 200 mA	"
5	High Current	10 Amp	Use separate Probe for Current only.

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