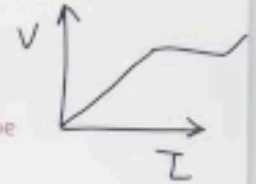
Resistor:

Resistor is a dissipative element, which converts electrical energy into heat when the current flows through it in any direction. The law governing the current into and voltage across a resistor is: $\boxed{v = R.i}$

The relationship is known as Ohm's law.

But resistor can be regarded as linear only within the specified limits, outside which the behavior becomes non-linear. The resistance of a resistor is temperature dependent and rises with temperature. Mathematically it can be represented as:



$$\boxed{Rt = R0(1 + \alpha t)}$$

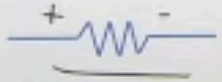
Where $R0$ = Resistance at 0°C and Rt = Resistance at t°C α = Temperature coefficient and it may be positive and negative both t = Temperature in °C And power dissipated by resistor is

$\boxed{p = v.i}$ put v = Ri

$p = i^2R$

$p = v^2/R$ Watts

Resistor is represented by the symbol



Unit of Resistance is ohm Ω

Capacitor (C):

It is a two terminal element that has the capability of energy storage in electric field. The law governing the $v - i$ relationship of capacitor is:

$$i = C\, dv/\, dt$$

Capacitor is represented by the symbol 

Unit of Capacitance is Farad (F)

In general, a capacitor has two conducting plates, separated by a dielectric medium. If positive voltage is applied across the capacitor, then it stores positive charge. Similarly, if negative voltage is applied across the capacitor, then it stores negative charge. So, the amount of charge stored in the capacitor depends on the applied voltage V across it and they have linear relationship. Mathematically, it can be written as

$Q \propto V$

$Q = CV$

Where,

- Q is the charge stored in the capacitor.
- C is the capacitance of a capacitor.

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$$i = \frac{dQ}{dt} = \frac{d(CV)}{dt}$$

$$i = C \cdot \frac{dV}{dt}$$

$$i \cdot dt = C \cdot dv$$

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$$dt \qquad dt$$

$$i = C \cdot \frac{dV}{dt}$$

$$i \cdot dt = C \cdot dv$$

Integrating both the sid

$$\int_0^t i\,dt = C \cdot \int dv$$

$$C \cdot V = \int_0^t i \cdot dt$$

$$V = \frac{1}{C} \int_0^t i \cdot dt$$

Integrating both the sides.

$$\int_0^t i\,dt = C \cdot \int dv$$

$$C \cdot V = \int_0^t i \cdot dt$$

$$V = \frac{1}{C}\int_0^t i \cdot dt$$

Voltage is not instantaneous.

$$= C\int V \cdot dV$$

$$W = \frac{CV^2}{2}$$

Where,

- Q is the charge stored in the capacitor.
- C is the capacitance of a capacitor.

$$i = \frac{dQ}{dt} = \frac{d(CV)}{dt}$$

$$i = C \cdot \frac{dV}{dt}$$

$$i \cdot dt = C \cdot dv$$

Integrating both the sides.

$$\int_0^t i\,dt = C \cdot \int dv$$

$$C \cdot V = \int^t i\,dt$$

Energy stored.

$$W = \int P\,dt$$

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

$$= \int v\,C \cdot dV$$

$$= C \int v \cdot dV$$

$$W = \frac{CV^2}{2}$$

Inductor (L):

It is a two-terminal storage element in which energy is stored in the magnetic field. The $v - i$ relation of an inductance is:

$$v = L\, di/\, dt$$

Inductor is represented by the symbol 

Unit of Inductance is Henry (H)

In general, inductors will have number of turns. Hence, they produce magnetic flux when current flows through it. So, the amount of total magnetic flux produced by an inductor depends on the current, I flowing through it and they have linear relationship. Mathematically, it can be written as

$$\Psi \propto I$$

$$\Psi = LI$$

Where,

- Ψ is the total magnetic flux
- L is the inductance of an inductor

- Ψ is the total magnetic flux
- L is the inductance of an inductor

$$V = L \cdot \frac{di}{dt}$$

$$V \cdot dt = L \cdot di$$

Integrating both sides.

$$\int_0^t v \cdot dt = i \cdot L$$

$$i = \frac{1}{L}\int_0^t v \cdot dt$$

In Capacitance current is not instanterous.

To calculate energy stored

$$W = \int p \cdot dt$$

$$= \int \underbrace{v \cdot i} \cdot dt$$

$$= \int i \cdot L \cdot di$$

$$= L \int i \cdot di$$

$$= L \frac{i^2}{2}.$$

Electrical Network:

An electrical network is any potential arrangement of different electric components (such as a resistor, inductor, capacitor, voltage source, and current source) connected in any way at all. We may classify circuit elements in two categories, passive and active elements.

Electric Circuit:

An electric circuit contains a closed path for providing a flow of electrons from a voltage source or current source. The elements present in an electric circuit will be in series connection, parallel connection, or in any combination of series and parallel connections.