Paper 1, TDC Part-1
Chapter– 1, Introduction to Passive Elements
Lecture - 1

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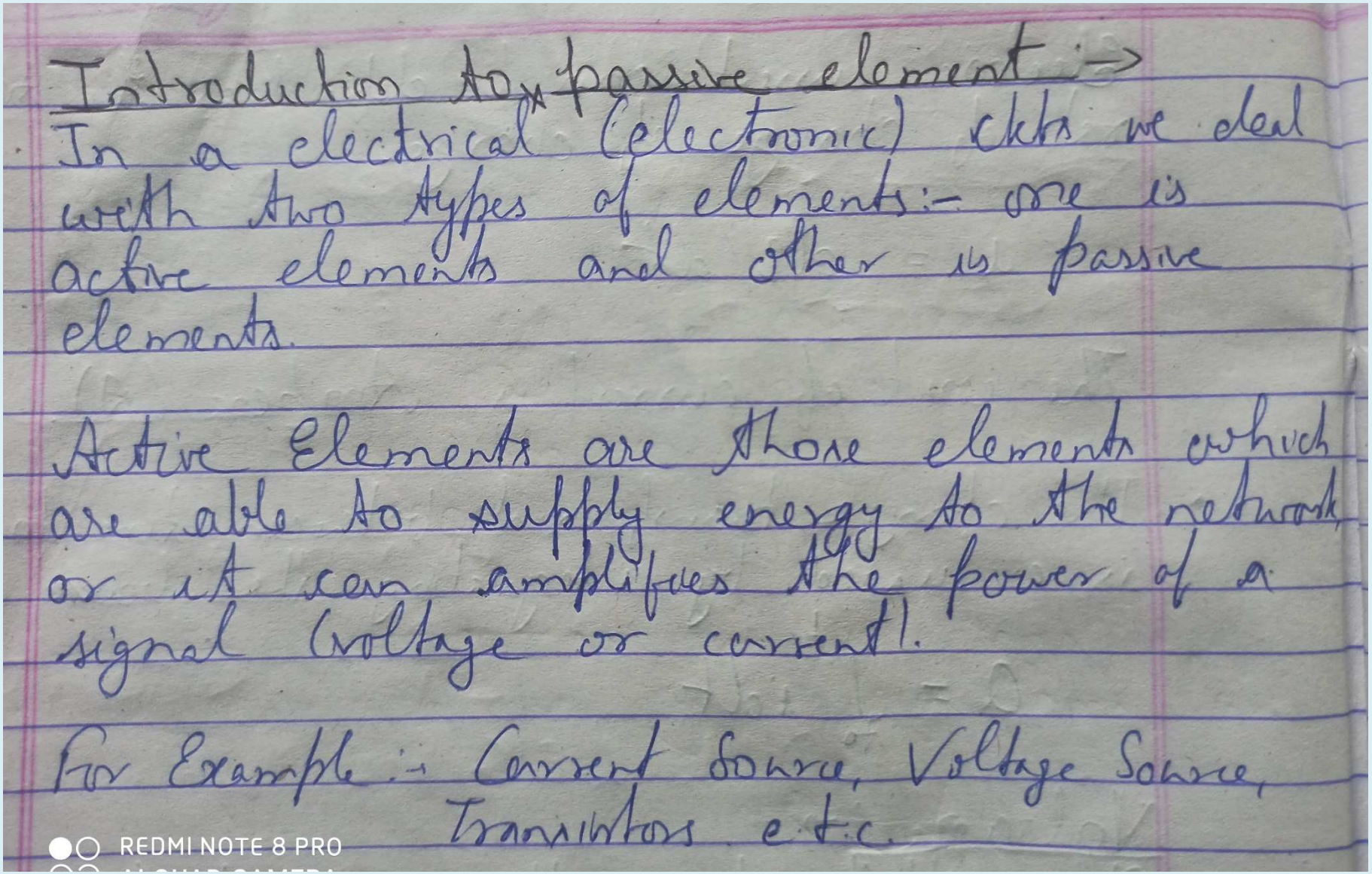
Introduction to Passive Elements



Introduction to passive element :→

In a electrical (electronic) ckts we deal with two types of elements:- one is active elements and other is passive elements.

Active Elements are those elements which are able to supply energy to the network, or it can amplifies the power of a signal (voltage or current).

For Example :- Current Source, Voltage Source, Transistors e.t.c.

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On the other hand "passive elements" are those elements which take energy from the sources and either convert it to another form or store it in an electric or magnetic field.

For example :-, Resistance, Capacitor, Inductor,

These passive elements are defined by the manner in which the voltage and current are related for the individual element.

For example - if the voltage and current is related by a constant, then the element is resistance. Similarly if the voltage

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is proportional to the time derivative of current, then the element is an inductance and if the current in the element is proportional to the time derivative of the voltage, then the element is a capacitance.

Resistance :-

It is the property of a substance due to which it opposes (or restricts) the flow of electricity (i.e. electrons) through it.

All electrical devices that consume energy must have a resistor (also called a resistance) in their circuit model.

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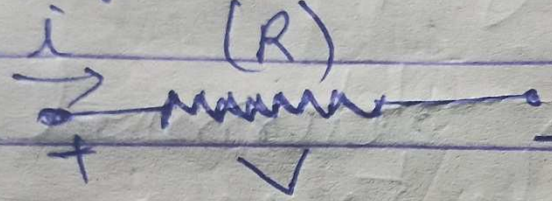
In a circuit or network resistance is ~~zero~~ represented by symbol (R)



Circuit / Network representation of Resistance

The practical unit of resistance is "ohm". A conductor is said to have a resistance of one ohm if it permits one ampere current to flow through it when one volt is applied across its

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terminal.

Symbol for ohm is 'R'.

Resistance of electrical conductor is very low
" " Insulator is very high
" " Semi-conductor lie in between conductor and insulator.

~~Current~~ Voltage - Current relationship of the Resistance is given by Ohm's law

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

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Power in the resistor, given by ~~$p = vi$~~

$$p = VI = \frac{V^2}{R} = I^2 R.$$

Power is always positive.

Energy is then determined as the integral of the instantaneous power

$$W = \int_{t_1}^{t_2} p\,dt = R\int_{t_1}^{t_2} I^2\,dt = \frac{1}{R}\int_{t_1}^{t_2} V^2\,dt.$$

(2) A 4.0 Ω resistor has a current $i = 2.5 \sin \omega t$ (A). Find the voltage, power and energy over one cycle given, $\omega = 50$ rad/s

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Sol:

$$V = RI = 4.0 \times 2.5 \sin \omega t \ (V)$$

$$V = 10 \sin \omega t \ (V).$$

$$P = VI = 2.5 \sin \omega t \times 10 \sin \omega t$$

$$= 25 \sin^2 \omega t \ (W).$$

$$W = \int_0^t p \, dt = \int_0^t 25 \sin^2 \omega t$$

$$= 25.0 \left[\frac{t}{2} - \frac{\sin 2\omega t}{4\omega} \right] \ J.$$

The resistance of any material with uniform cross-sectional area A depends on A and its length l and is mathematically it is expressed as,

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is expressed as,

$$R = \rho l / A$$

where ρ is known as the resistivity of a material in ohm-meters.

Ohm's law state that the voltage V across a resistor is directly proportional to current I flowing through the resistor. $V \propto i$

Ohm defined the constant of proportionality for a resistor to be the resistance, R

$V = IR \rightarrow$

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For any query contact- 9771474020

Thank You