LECTURE NOTES

On

Circuit & Network Theory

On

3rd Semester of Electrical Engineering Branch

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Ch-1

Voltage

- energy is required for the moment of charge from one point to another point. These energy required to move a positive charge from one point another is known as voltage
- even if there is no charges between two point voltage can be there existings.
- voltage is given by

$$V = \frac{\text{energy required}}{\text{charge}}$$

$$\boxed{V = W/q \quad J/C}$$

$$\text{unit} - \frac{\text{Joule}}{\text{Coulmb}} = \text{Volt} = V$$

Current

- It is the movement of electric charges along a definite path
- unit of current is ampere(A)

Power

- It is the workdone per unit time
- $P = \frac{\text{workdone}}{\text{time}} = W/t$

$$P = \frac{\text{work}}{\text{charge}} \times \frac{\text{charge}}{\text{time}}$$

$$P = V \times I$$

- unit of power is watt.

Energy

- It is defined as the power consumed to give the
- $W = P \times t$
  $VI \times t$
- unit of energy is Joule/watt second (kWh)

Resistance

- The property by which current is opposed to flow in an element is known as resistance.

Ohm's law

It states that under constant temperature in a conductor voltage is directly proportional to current

$V \propto I$

$\Rightarrow V = IR$

where 'R' = Resistance

Proportionality constant known as resistance of conductor

unit - Ω ohm

Inductance (L)

- Voltage is induced in a conductor when placed in a varying magnetic field.

- Induced voltage $\propto$ time rate of change of current

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

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

where 'L' Inductance

- unit Henry (H, m)

Capacitance (F)

A capacitance is a physical device which when polarised by an electric field by applying a suitable voltage stores energy in the form of charge separation.

The capability of a capacitor to store energy in charge its measure in form of capacitance.

$$C = q/V = \frac{\text{coulomb}}{\text{volt}}$$

unit = faraday (F)

Bilateral & unilateral elements

Bilateral

Bilateral element conducts equally well in either condition.

ex - resistor, Inductor

unilateral

when the current voltage relation are different for the 2 direction of current flow is known as unilateral element.

ex - diode

linear & non-linear element

when the current & voltage relation in an element can be stimulated by a linear equation either algebric differential or Integral type the element is said to be linear element.

ex = resistor, capacitor

Non-linear

when the current & voltage relationship in ckt cannot be stimulated by a linear equation the element is said to be non-linear element.

Active & Passive element

Active element produces energy in the from of voltage or current

ex:- capasitor.

Passive element stores energy in the from of voltage or current.

ex:- resistor.

21 sep

Resistivity

Resistance of an element depends upon the length area or cross section directly and Inversly respectively

$$R \propto \frac{l}{A}$$

$$R = \rho \frac{l}{A} \qquad \rho = \frac{RA}{l}$$

where ρ = proportionality constant known as Resistivity of the conductor.

unit of Resistivity is = Ω-m

Conductance (G)

It is opposite of resistance that is that is the property of an element to allow current to pass through it

unit = mho (℧)

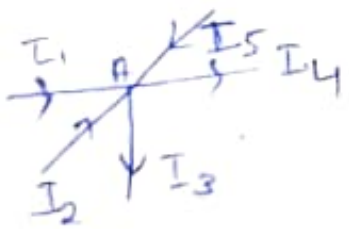
Conductivity (σ)

$$\sigma = \frac{1}{\rho} = \frac{l}{RA}$$

unit = mho/m.S

Kirchhoff's current law (KCL)

If there is node OR point where Incomming & outgoing current are present then Incomming current will always be equal to the summation of out going current.



Incoming current = I_1, I_2, I_5

out going current = I_3, I_4

according to KCL ⇒ Summation of In Incoming current = Summation of out-going current

$$I_1 + I_2 + I_5 = I_3 + I_4$$