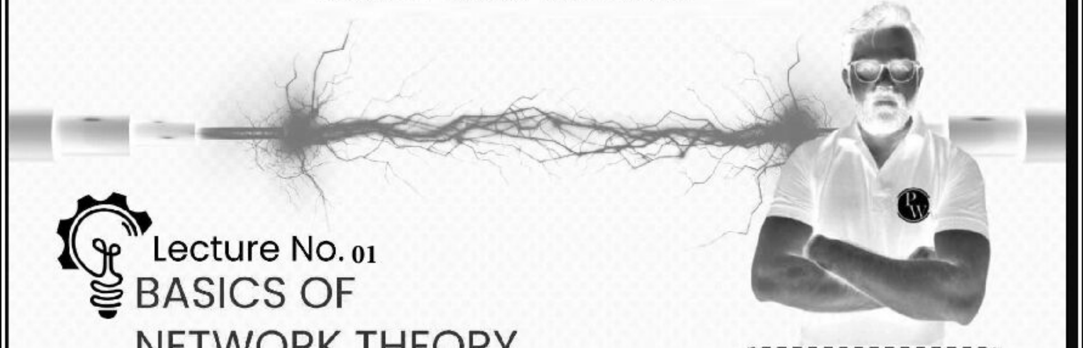
Electrical Engineering

Electronics and Communication Engineering

NETWORK THEORY



Lecture No. 01

BASICS OF NETWORK THEORY

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1. Basics
2. $q(t)$, $i(t)$, $v(t)$
3. $P(t)$, $w(t)$
4. Power absorbing
5. Power Delivers
6.

[Basics of Network theory]

- charge ($q(t)$)
- current ($i(t)$)
- Voltage ($v(t)$)
- Power ($P(t)$) ⟷ Energy ($W(t)$ or $E(t)$)

↓

[Basic Building block of N/w theory]

[Charge. ($q(t)$) → It is a bipolar → ⊕ / ⊖]

- It is the most fundamental Quantity.
- Charge exposure can be felt.

↓

charge has two electrical effects.

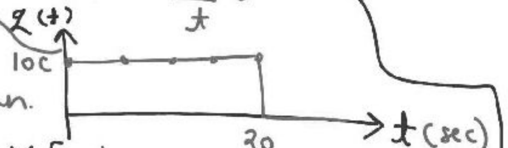
- Separation of charge (Energy will be expended) to create the force).
  ↓
  Force → $v(t)$ → voltage
- flow or Motion of charge.
  ↓
  It creates electric fluid.
  ↓
  current ($i(t)$).

$v(t) = \dfrac{dw}{dq} \rightarrow$ 'volt' $\rightarrow$ J/C

$i(t) = \dfrac{dq}{dt} \rightarrow$ (Ampere) $\rightarrow$ C/Second

or

$i(t) = \dfrac{q}{t}$



$i(t) = \dfrac{dq(t)}{dt}$ $= \dfrac{d}{dt}(10)$ $= (0\ A)$ ✓

General expression (Always applicable)

X $\left[i(t) = \dfrac{10}{20} = \dfrac{1}{2} = 0.5\ A \right]$

Conditional expression & Valid if we have constant current

$q \propto t$

• $q(t) = 10\, t \rightarrow$ Ramp signal

$y \quad m \quad x$

$i(t) = \dfrac{dq(t)}{dt}$

$i(t) = (10 \times 1)$

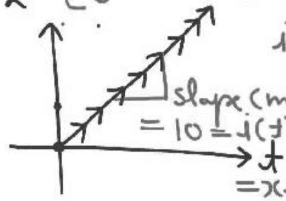
$\int dq(t) = \int i(t) \cdot dt$

= y-axis $q(t)$ $[y = mx]$

$i(t) = \dfrac{d}{dt}(10t)$

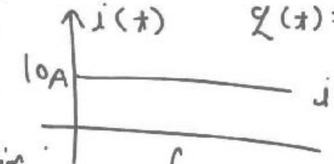
$i(t) = \dfrac{d}{dt}(q(t))$

$$\boxed{q(t) = \int i(t) \cdot dt}$$



slope (m) = 10 = i(t) = rate of change = Differentiation = Slope (m)

= x-axis



$q(t) = i(t) \times t$

$i(t) = \dfrac{q(t)}{(t)}$

$q(t) = \int 10 \cdot dt = 10 \times t$

Note:

① $\dfrac{d}{dt}(f(t)) \longrightarrow$ Slope of f Vs t curve.

② $\int f(t)\, dt \longrightarrow$ Area of f Vs t curve

• The relation b/w $v(t)$ & $i(t)$ can be co-related with Power & energy.

$P(t) = \text{Power} = \dfrac{dw(t)}{dt} \cdot \dfrac{dq}{dq}$

$P(t) = \left(\dfrac{dq}{dt}\right) \times \left(\dfrac{dw}{dq}\right)$

$\dfrac{dq}{dt} \rightarrow i(t)$, $\dfrac{dw}{dq} \rightarrow v(t)$

$$\boxed{P(t) = v(t) \cdot i(t)}$$

• $P(t) = \dfrac{dw(t)}{dt} \longrightarrow \int dw(t) = \int P(t)\, dt$

$$\boxed{w(t) = \int P(t) \cdot dt}$$

$$p(t) = \frac{dw(t)}{dt}$$ → Rate of change of energy w.r.t time
→ Slope of $w(t)$ Vs 't' graph.

$$w(t) = \int p(t) \cdot dt$$ → Area under the curve [$P(t)$ Vs 't']

Topic-02. Concept of Absorbing & Delivering Power.

Network.

- It is a just connection of electrical elements.
- Minimum requirement of element to form a N/w is 2.

Circuit.

- It is also the connection of electrical elements but with certain fixed requirements.

(1) It must have atleast one Independent Source

(2) It must have atleast one closed path.

Note: "All circuits are always Network but all networks are not neccessarily to be a circuit"

Condition for the flow of current.

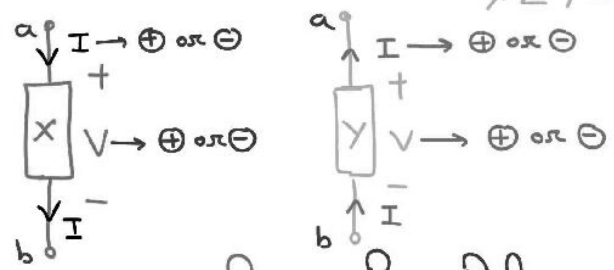
There are three-must condition:

Cod^n 01: There must be atleast one Independent Source in the N/w or Circuit.

Condition 02: There must be atleast one closed Path.

Condition 03: There must be a return path also.

X & Y → can be Any element.



P_x → Absorbing Power

$P_x = (V \cdot I)$ → ⊕ or ⊖

It is Independent of the sign of V & I.

P_y → Delivering Power

$P_y = V \cdot I$ → ⊕ or ⊖

It is independent of Sign of V & I.

- In a $\boxed{\text{whole}}$ electrical circuit:

(1) $$\left[\sum P_T \text{ or } \sum W_T = 0\right]$$

→ Energy or Power conservation Principle.

or

→ Energy can not be created or can not be destroyed.

(2) In a whole circuit,

$$\left[\sum P_T(\text{Actual Deliver}) = \sum P_T(\text{Actual absorb})\right]$$

$\boxed{\text{@ pankajshukla sir pw}}$

(telegram)