Electrical Engineering

Electronics and Communication Engineering

NETWORK THEORY

Lecture No. 01

BASICS OF NETWORK THEORY

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Topics to be Covered

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 ↔ Energy
  - ($P(t)$)
  - ($W(t)$ 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 ($i(t)$)

$$v(t) = \frac{dW}{dq} \rightarrow \text{'volt'} \rightarrow J/C$$

$$i(t) = \frac{dq}{dt} \rightarrow (\text{Ampere}) \rightarrow C/\text{second}$$

or

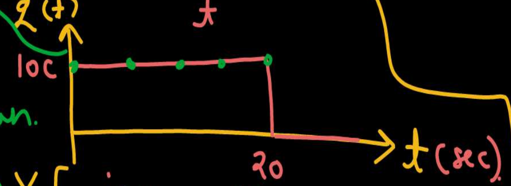
$$i(t) = \text{'}\frac{q}{t}\text{'} \checkmark$$

General expression (Always applicable)

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

$$= \frac{d}{dt}(10)$$

$$= (0\ A) \checkmark$$



$$\times \left[\, i(t) = \frac{10}{20} = \frac{1}{2} = 0.5\ A \,\right]$$

conditional expression & valid if we have constant current

$$q \propto t$$

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

$q(t) = y$ = y-axis, $10 = m$, $t = x$

$$q(t)\,[\,y = mx\,]$$

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

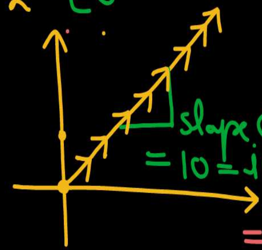
$$\int 1\,dq(t) = \int i(t)\cdot dt$$

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

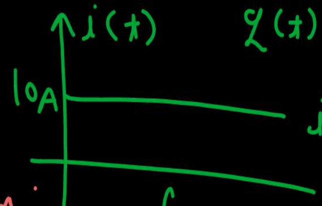
$$i(t) = \frac{d}{dt}(10t)$$

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

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



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



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

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

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

Note:

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

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

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

$$P(t) = \text{Power} = \frac{dW(t)}{dt}\cdot\frac{dq}{dq}$$

$$P(t) = \left(\frac{dq}{dt}\right) \times \left(\frac{dW}{dq}\right)$$

$\frac{dq}{dt} \rightarrow i(t)$, $\frac{dW}{dq} \rightarrow v(t)$

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

- $P(t) = \frac{dW(t)}{dt} \rightarrow \int 1\,dW(t) = \int P(t)\,dt$

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

$P(t) = \frac{dW(t)}{dt}$ → Rate of change of energy wrt 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.

$\boxed{\text{Network.}}$

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

$\boxed{\text{Circuit.}}$

- 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 necessarily to be a circuit"

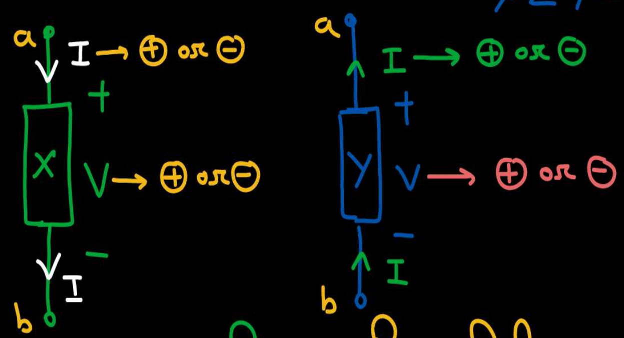
Condition for the flow of current.

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)

Thank you

GW

Soldiers !