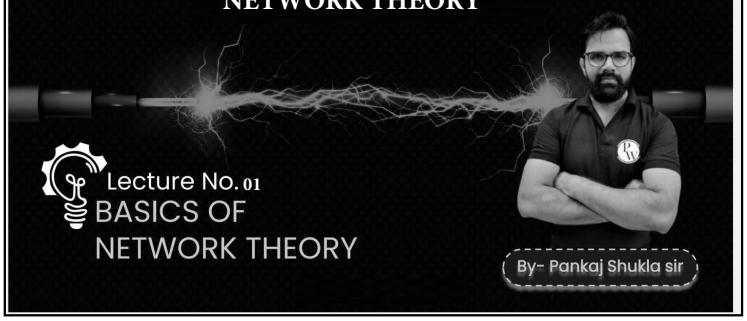
Electrical Engineering

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 Delivered
6.

Basics of Network theory

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

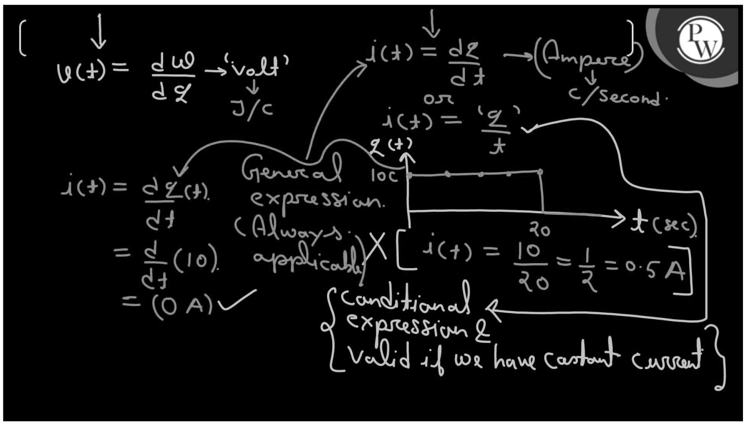
[Basic Building block of N/w theory]

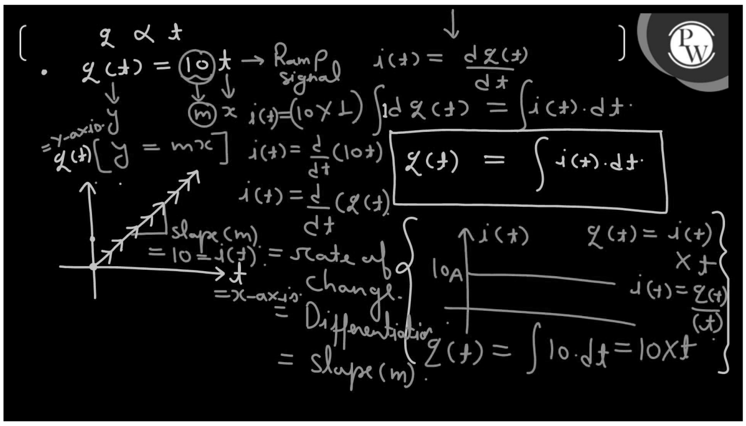
Charge ($q(t)$) → It is a bipolar. (⊕, ⊖)

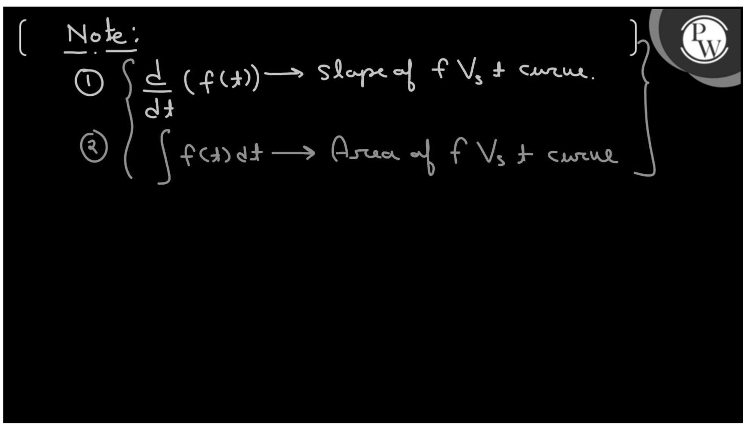
- It is the most fundamental quantity.
- Charge exposure can be felt.

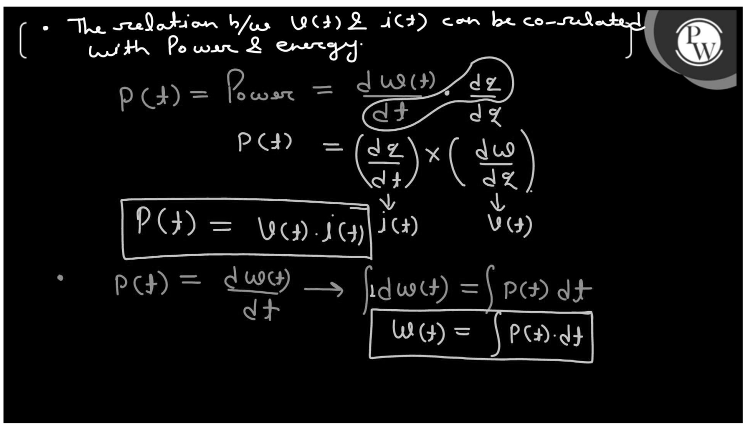
Charge has two electrical effects.

- 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) = dW/dq → 'volt'
J/C
i(t) = dq/dt → (Ampere)
C/second
or
i(t) = 'q/t'
q(t)
10C
20
t (sec)
i(t) = dq(t)/dt
= d/dt (10)
= (0 A)
General expression (Always applicable)
i(t) = 10/20 = 1/2 = 0.5 A
Conditional expression & Valid if we have constant current


q ∝ t
q(t) = 10 t → Ramp signal
m x
= y-axis y
q(t) [y = mx]
i(t) = dq(t)/dt
i(t) = (10 × 1)
∫1 dq(t) = ∫i(t)·dt
i(t) = d/dt (10t)
i(t) = d/dt (q(t))
q(t) = ∫i(t)·dt
slope (m) = 10 = i(t) = rate of change
t = x-axis
= Differentiation
= Slope (m)
i(t)
10A
q(t) = i(t) × t
i(t) = q(t)/(t)
q(t) = ∫10·dt = 10×t


Note:
① d/dt (f(t)) → Slope of f Vs t curve.
② ∫f(t)dt → Area of f Vs t curve


The relation b/w v(t) & i(t) can be co-related with Power & energy.
P(t) = Power = dW(t)/dt · dq/dq
P(t) = (dq/dt) × (dW/dq)
i(t)
v(t)
P(t) = v(t)·i(t)
P(t) = dW(t)/dt → ∫1 dW(t) = ∫P(t) dt
W(t) = ∫P(t)·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 necessarily to be a circuit"

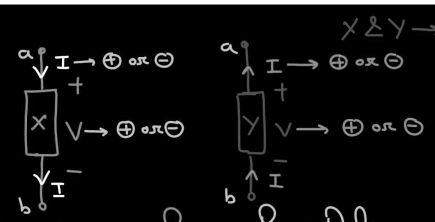
Condition for the flow of current.

There are three-must condition:

Cond^{n}01: There must be atleast one Independent Source in the N/w or circuit.

Condition02: There must be atleast one closed path.

Condition03: There must be a return path also.



X & Y → can be any element.

P_x → Absorbing Power

$P_x = (V \cdot I) \rightarrow \oplus$ or $\ominus$

It is Independent of the sign of V & I.

P_y → Delivering Power

$P_y = V \cdot I \rightarrow \oplus$ or $\ominus$

It is independent of sign of V & I.

- In a whole electrical circuit :

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

---> Energy or Power conservation Principle.
or
Energy can not be created or can not be destroyed.

(2) In a whole circuit,

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

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(telegram)

Thank you

GW Soldiers !