NETWORK

[Kiran_networks_machines]

Syllabus :→

1. BASICS
2. Steady state A.C circuits [Resonance]
3. Theorems.
4. Transients
5. two port network
6. magnetic coupled circuits
7. Graph theory (ESE)
8. Filters (ESE)
9. 3-ϕ circuits. [shifted to power systems]

1) Fundamentals of electric circuits
By Alexander and Saidku (bit.ly/33IEMRD)

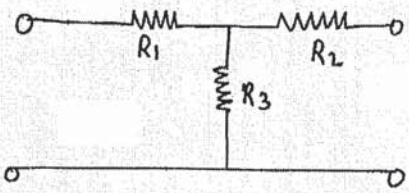
2) Engg. circuit Analysis.
By Hayt and kemmerly.

3) Network Analysis. [conventional question]
By Vanvalkenburg.

1) Homework
2) workbook
3) Previous papers
   - GATE → EE, EC, IN
   - IAS → conventional, objective
   - PSU
   - Test series

* Difference between NETWORK AND CIRCUIT:

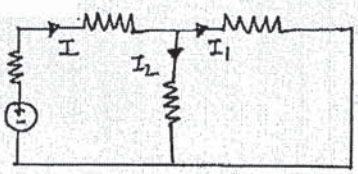
Network :→ it is combination of elements, its may or may not consists of closed path, or its may or may not have independent source.



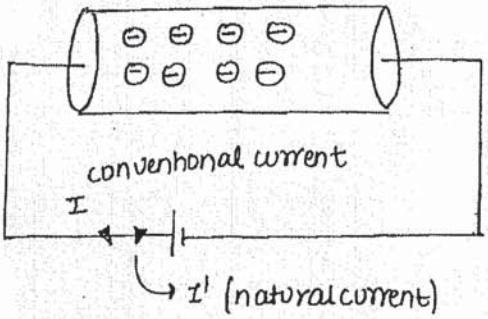
T-Network

Ex: (interview)
(wireless communication)
(internt)

circuit :→
it is combination of elements, but it have ~~connected~~ one closed path, or it have atleast one independent source



Ex: (interview)
(Electrical transmission line)



Charge of electron = $-1.602 \times 10^{-19} C$

(1) CURRENT (I)

Flow of electron is called current.

(2) $\boxed{I = \frac{dQ}{dt}}$ Rate of change of charge w.r.t to time.

- current Always flows from higher potential to lower potential.
- unit of current :→ C/s or Ampere.

3) $\boxed{Q = \int_{-\infty}^{t} I\,dt} = \int_{-\infty}^{0} I\,dt + \int_{0}^{t} I\,dt$ ($\int_{-\infty}^{0} I\,dt = Q_0$)

$\boxed{Q = Q_0 + \int_{0}^{t} I\,dt}$

(Q_0 : Initial charge)

(3) voltage

EMF :- electron move from one point to another point in conductor an force is required. which is called electro motive force.

$\boxed{V = \frac{dw}{dQ}}$ $\boxed{\text{unit} = J/C \text{ or } \text{unit} = \text{volt}}$

(4) power

The time rate of energy is power.

$\boxed{P = \frac{dw}{dt} = \frac{dw}{dq}\cdot\frac{dq}{dt} = V \cdot I}$

$\boxed{P = VI \text{ OR } \frac{V^2}{R} \text{ OR } I^2R}$

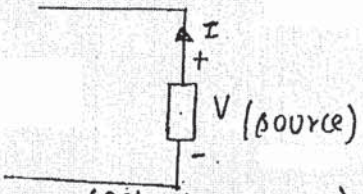
$\boxed{P = V^2 q}$

(5) conductance

Reciprocal of Resistance is called conductance.

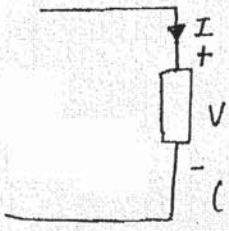
unit = mho OR siemens , $G = \frac{1}{R}$ (mho) or $(ohm)^{-1}$

(6) source / sink



(Delivering power)

source :→ current leave from positive terminal



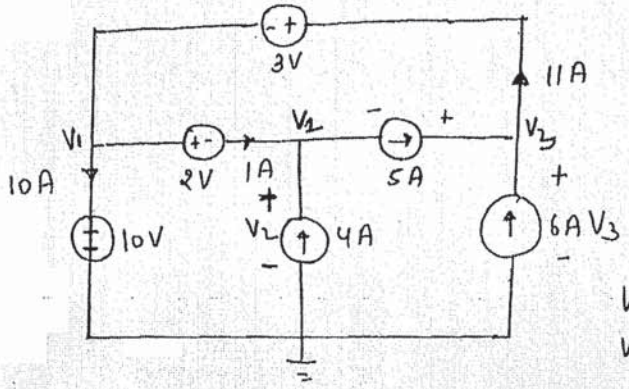
(Absorbing power)

sink : current enter into positive terminal

Note:

(1) when current is leaving from positive terminal element is (Delivering power).

(2) when the current is entering ~~from~~ at positive terminal element is (Absorbing power).



$V_1 = 10V$

$V_1 - V_2 = 2$

$V_2 = 8$

$V_2 - V_3 = -3$

Qu.1 Find power of each element of network shown on left side page?

(1) $P_{10V} = +10V \times 10 = 100$ (Absorbing power).

(2) $P_{2V} = 2A \times 1 = 2$ [Absorbing].

(3) $P_{3V} = 3 \times 11 = 33$ [Absorbing].

(4) $P_{4A} = 4 \times 8 = 32$ (Delivering)

(5) $P_{6A} = 6 \times 13 = 78$ (Delivering)

(6) $P_{5A} = (V_2 - V_3) \times 5A$

$= (8 - 13) \times 5$

$= 25$ (~~Absorbing~~) (Delivering)

$P_{absorbing} = 100 + 2 + 33$

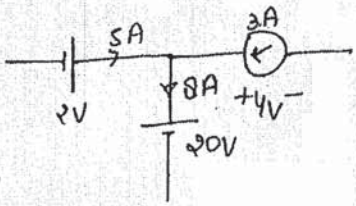
$= 135W$

$P_{delivering} = 78 + 32 + 25$

$= 135W$

$P_{delivering} = P_{absorbing}$

Qu.2 Find total power absorbing of figure shown



$P_{20V} = 8 \times 20 = 160$ (absorb)

$P_{3A} = 4 \times 3 = 12$ (deliver) $= -12$ (absorb)

$P_{2V} = 5 \times 2 = 10$ (deliver) $= -10$ (absorb)

$= 160W + 12W - 10W$

$= (160 - 22)\ W$

$138W$

Energy

capacity to do work is called Energy.

$$w = \int_0^t p\,dt$$

$$w = \int_0^t VI\,dt$$

$$w = pxt$$

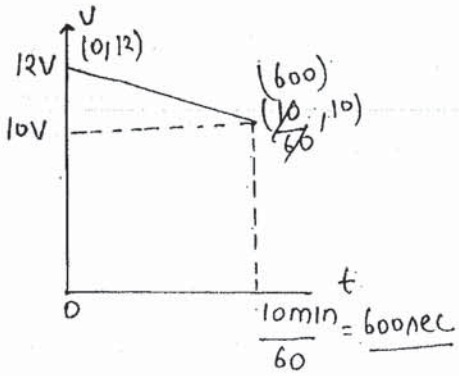
$$w = VIt$$

Joule or watt sec

Qu.3 A fully charged mobile phone is good for 10 min talk time. During talk time, battery delivery a constant current of 2A. Find Energy of battery during talk time.

Sol

$$\text{Energy} = \int_0^t p\,dt = \int_0^t VI\,dt = 2\int_0^t V\,dt$$



$$(y-12) = \left(\frac{12-10}{-600}\right)x \quad (x)$$

$$(y-12) = \frac{-12x}{600}$$

$$(V-12) = -12t - \frac{1}{300}t$$

$$V = -12t + 12$$

$$-t/300 + 12$$

$$= 2\int_0^{10/60} (-12t+12)\,dt$$

$$= 2 \times 12\left[\frac{-t^2}{2} + t\right]_0^{1/6}$$

$$= 24\left[\frac{(-1/6)^2}{2} + 1/6\right]$$

$$= 24\left[\frac{1}{6} + \frac{1}{72}\right]$$

$$= 2\int_0^{600} \left(\frac{-t}{300} + 12\right) dt$$

$$= 12\left[\frac{-t^2}{600} + 12t\right]$$

$$= 2 \times 6600$$

$$= 13200\ J$$

method-2

Area method

calculate total Area

$$= \frac{1}{2}[12+10]\times 600$$

$$Vt = 6600$$

Use Always time in sec

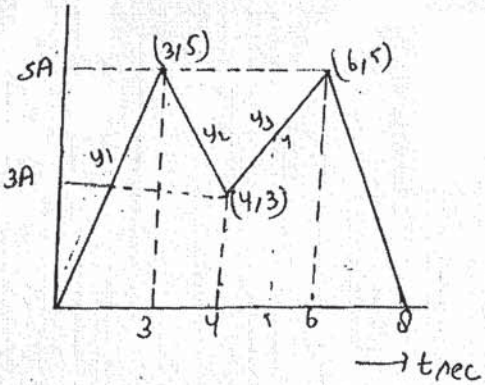
$$\text{Energy} = VIt$$
$$= 6600\times 2$$
$$= 13200$$
$$= 13.2\,kJ$$

Note:

$i = Q \times t$ not valid.

$i = \frac{dQ}{dt}$ ALWAYS ONLY USE METHOD-1.

Qu.4



Find charge acquired by capacitor in 5 sec

$$I = \frac{dQ}{dt}$$

$$dQ = \int I\,dt$$

$$dQ = \int_0^3 5/3\,t + \int_3^4 (-2t+11) + \int_4^5 (t-1)\,dt$$

$y_1 = \frac{5}{3}x \quad y_1 = 5/3\,t$

$(y_2 - 3) = -2(t-4)$

$y_2 = -2t+8+3$

$y_2 = -2t+11$

$(y_3 - 3) = (t-4)$

$y_3 = t-1$

$$5/3\left(\frac{9}{2}\right) + \left[-\frac{2t^2}{2} + 11t\right]\Big|_3^4 + \left(\frac{t^2}{2} - t\right)\Big|_4^5$$

$$= \frac{45}{6} + \left(-\frac{2\times 7}{2} + 11\right) + \left(\frac{9}{2} - 1\right)$$

$$= 7.5 + 4 + 3.5$$

$$= 15\ A$$

* CLASSIFICATION OF ELEMENTS :→

(1) Active and passive elements :→

(2) Linear and non linear

(3) unidirectional and bidirectional

(4) Time variant and invariant

(5) Lumped and Distributed