

Electric Circuits

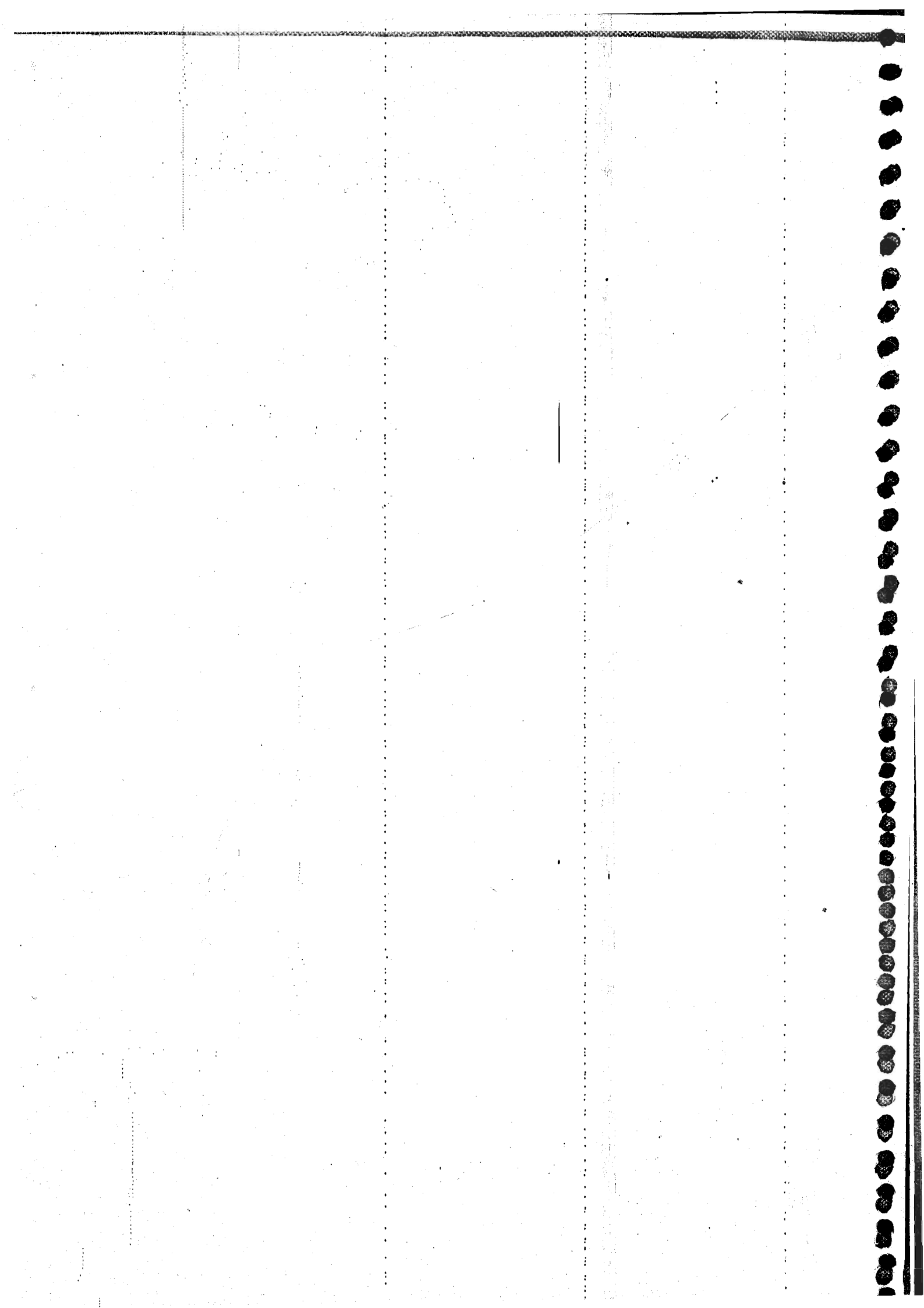
- ① Basics (V, I, R, L, C)
- ② Series, Parallel, λ/Δ , source transformation.
- ③ KVL, KCL (Mesh Analysis and Nodal Analysis)
- ④ Ac circuit
- ⑤ Theorems.
- ⑥ Magnetic circuits

Fundamental of Electric circuits
by Alexander & Sadky

Electric Machines

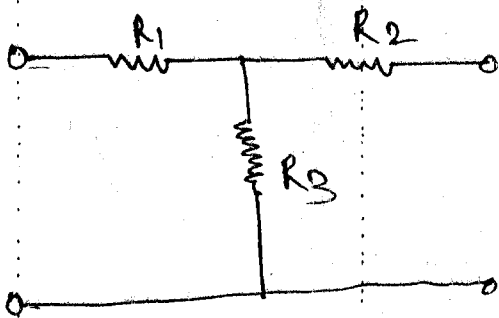
- ① Transformer
- ② DC motor and generator
- ③ AC motor and generator
- ④

Electrical Technology
by - B.L. Theraja Vol-II

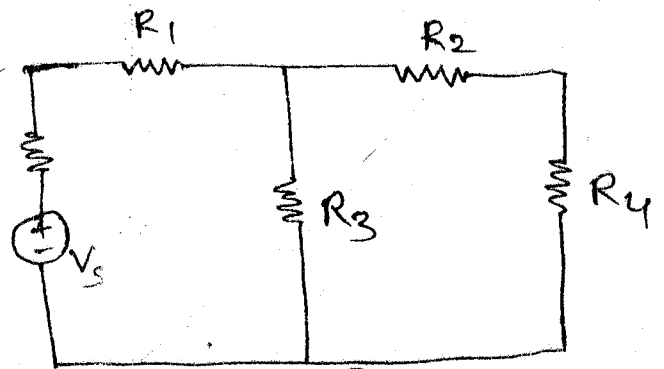


* Network is a combination of elements, it may or may not consist of closed path.

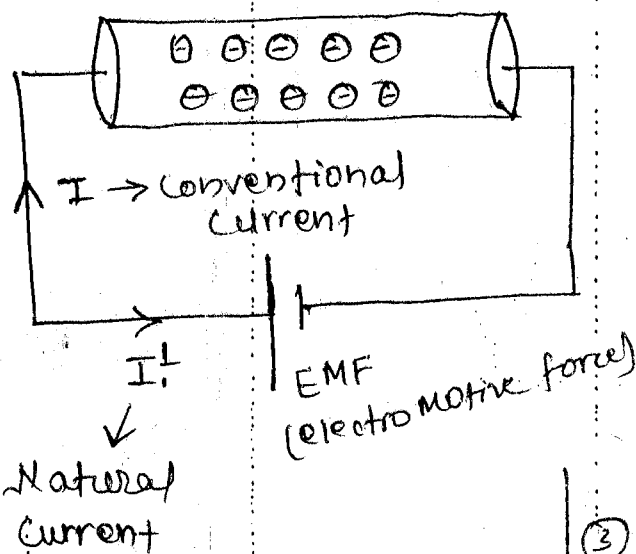
* Circuit is a combination of elements and it should consist of closed path.



T:- Network



Network (or) Circuit



① Charge (Q):

$$e = -1.602 \times 10^{-19} \text{ C}$$

② Current (I)

$$I = \frac{dq}{dt} \cdot \text{c/s (or) Amp}$$

$$Q = \int_0^t I dt$$

③ Volt

$$V = \frac{dW}{dq} \cdot \text{Joules/C (or) Volt}$$

④ Power:

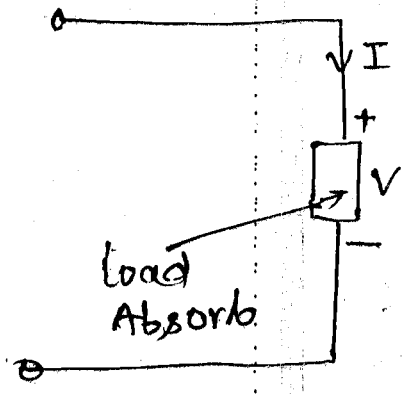
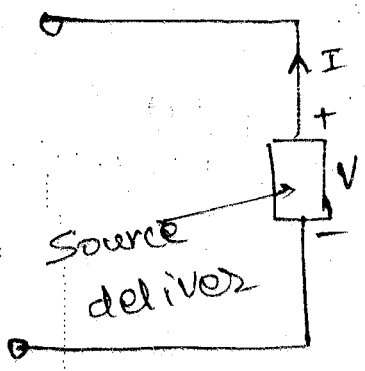
$$P = \frac{dW}{dt} \cdot \text{Joules/sec (or) Watts}$$

$$P = \frac{dW}{dq} \cdot \frac{dq}{dt}$$

$$P = VI = I^2R = \frac{V^2}{R} = V^2G = \frac{I^2}{G}$$

$$G = \frac{1}{R}$$

$G \rightarrow$ conductance



Note:

- * ① ~~When the current is leading~~ When the current is leading leaving from +ve terminal element is delivering power.
- * ② When the current is entering at +ve terminal element is absorbing power.

③ Find power of each elements of the Network shown

$$V_4 = 0$$

$$V_1 - V_2 = 2$$

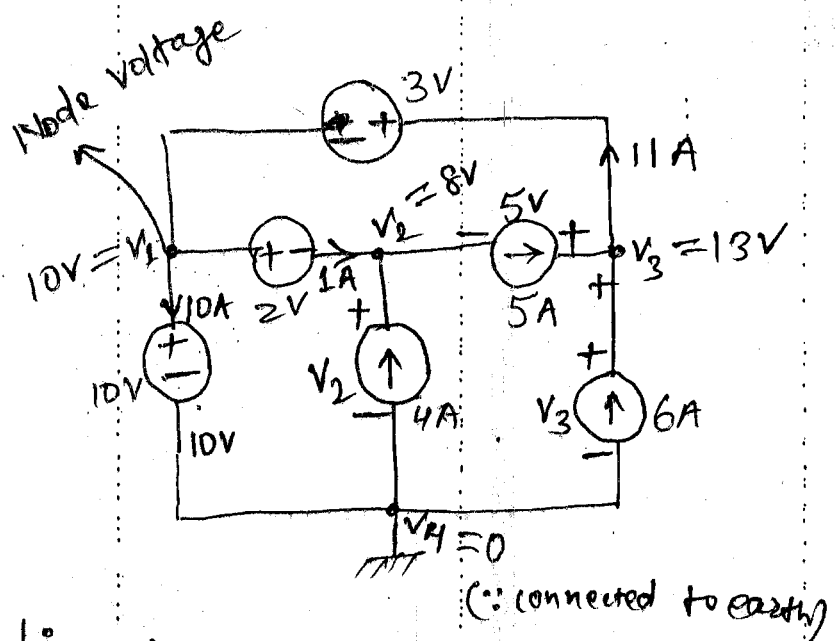
$$10 - V_2 = 2$$

$V_2 = 8$

$$V_3 - V_1 = 3$$

$$V_3 - 10 = 3$$

$V_3 = 13$



$$P_4 = 4 \times 8 = 32W \text{ (Deliver)}$$

$$P_6 = 6 \times 13 = 78W \text{ (Deliver)}$$

$$P_3 = 3 \times 11 = 33W \text{ (Absorv.)}$$

$$P_{10} = 10 \times 10 = 100W \text{ (Absorv.)}$$

$$P_2 = 2 \times 1 = 2W \text{ (Absorb.)}$$

$$(P_T)_{\text{Absor.}} = (P_T)_{\text{Deliver}}$$

* Energy:-

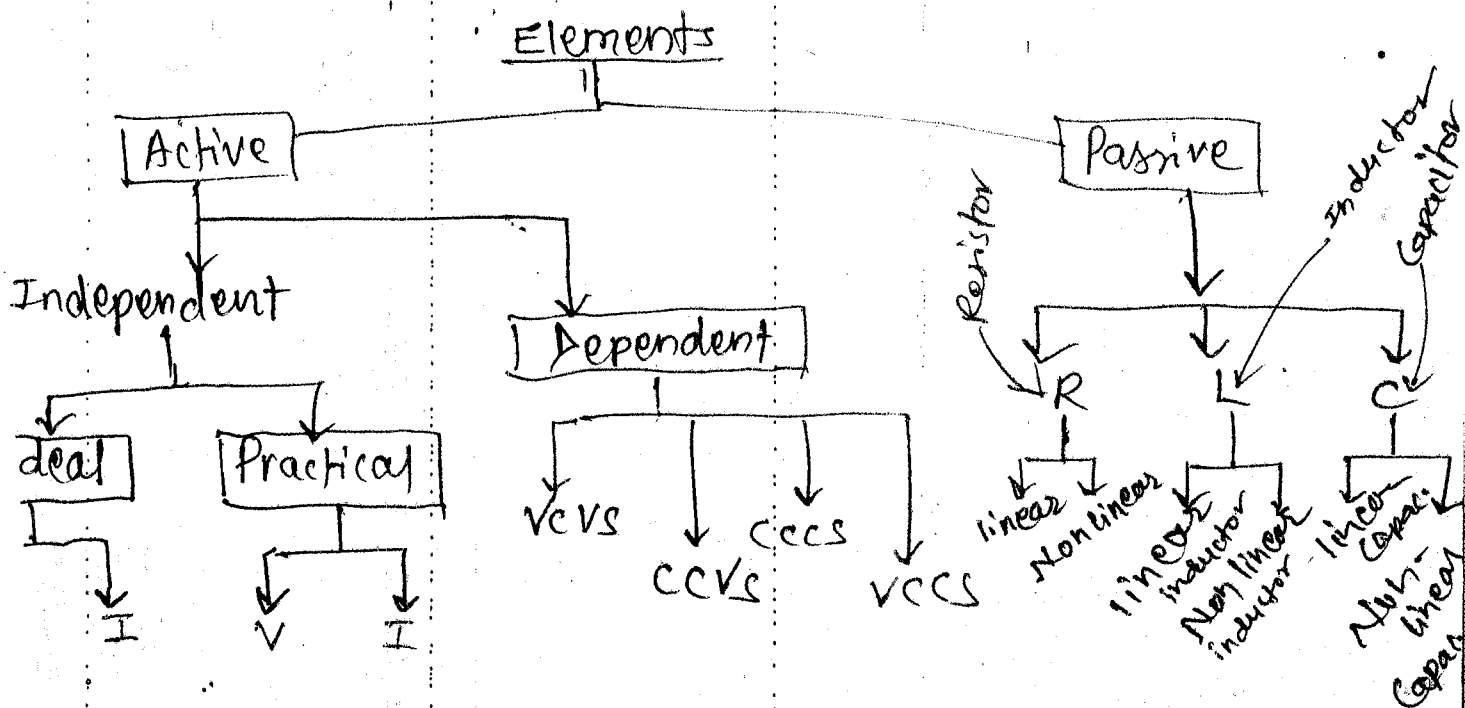
The capacity to do the work is called as Energy.

$$W = \int_0^t P \cdot dt \quad \text{Joules or watt-sec}$$

$$W = \text{Power} \times \text{Time}$$

* Classification of Elements:-

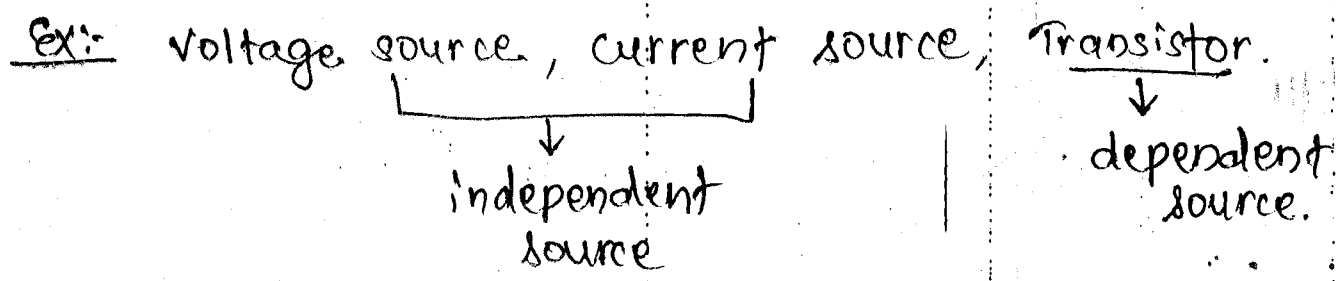
- ① Active and Passive Elements
- ② Linear and Non-linear elements.
- ③ Uni-directional and Bi-directional elements.



- ~~VVCS~~ → Voltage control voltage source
- CCVS → Current control voltage source
- CCCS → Current control current source
- VCCS → Voltage control current source

⊗ Active Element.

When the element is capable of delivering energy independently for long time ~~is~~ is called as Active Element.

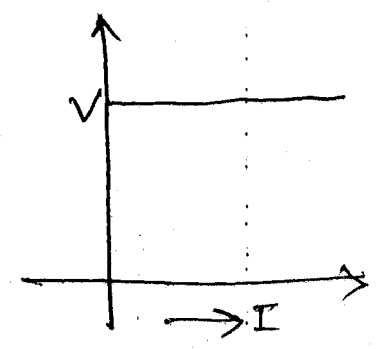
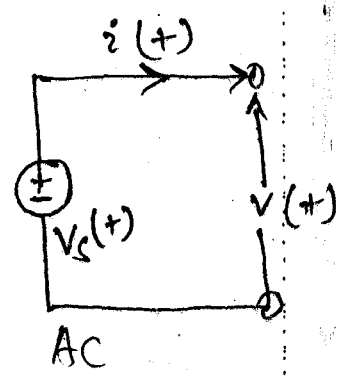
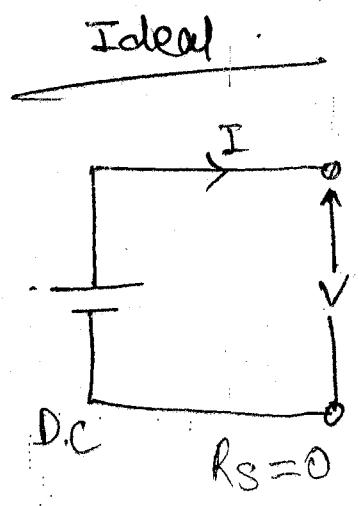


⊗ Passive Elements:-

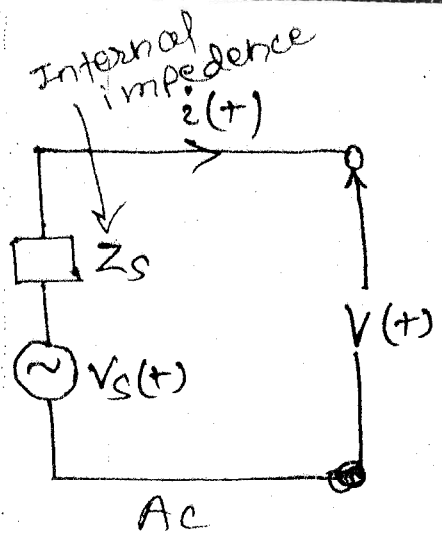
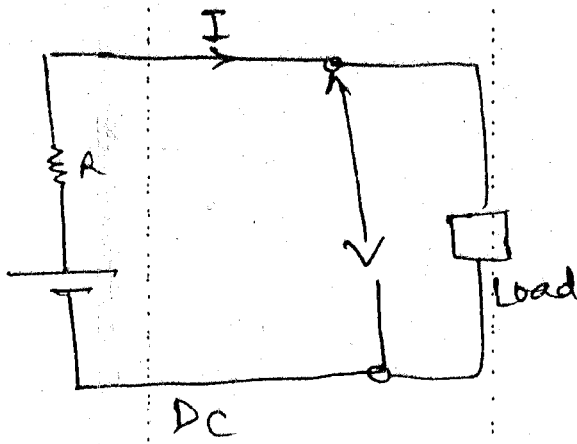
When the Element is not capable of delivering Energy independently then it is called as passive Elements.

- Ex ① Resistor
- ② Bulb

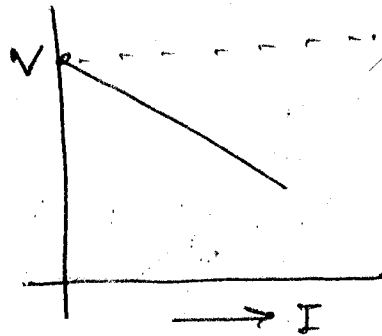
Voltage source



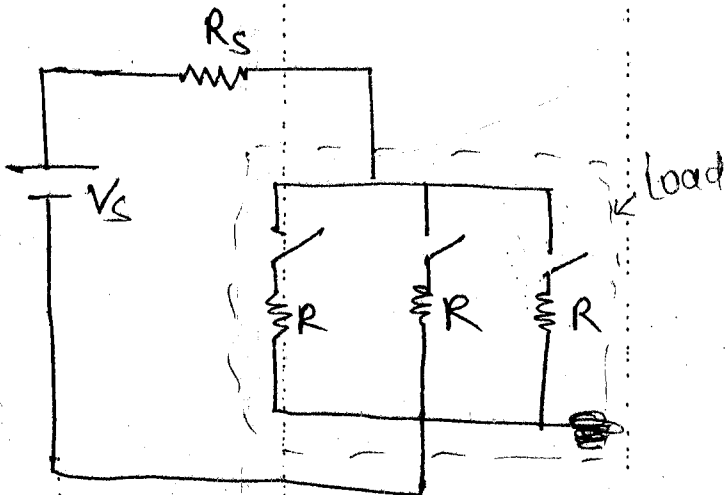
Practical



V vs I characteristic curve



Ex.



$$I_1 = \frac{V_s}{R_s + R}$$

$$I_2 = \frac{V_s}{R_s + \frac{R}{2}}$$

$$I_3 = \frac{V_s}{R_s + \frac{R}{3}}$$

$$I_1 < I_2 < I_3$$

$$V_s = V + IR_s$$

$$V = V_s - IR_s$$