① **Kirchoff's Laws:-**

1st law:- The sum of voltage drops around a closed loop is equal to sum of voltage sources of that loop. [Voltage law]

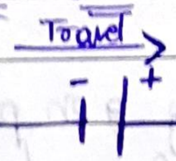
- Closed loop must have 2 conditions:-

(i) It must have one or more voltage sources.
(ii) It must have a complete path for current flow from any point, around loop, & back to that point.

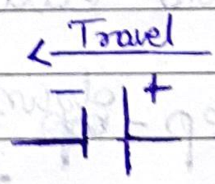
② **2nd law:-** The current arriving at any junction point in circuit is equal to current leaving that junction (Kirchhoff's Current law).

* **Sign Convention:-**

(a) **For emf:-**

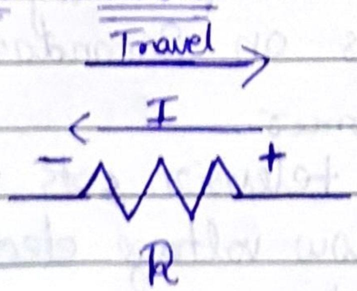


$\Rightarrow +E$

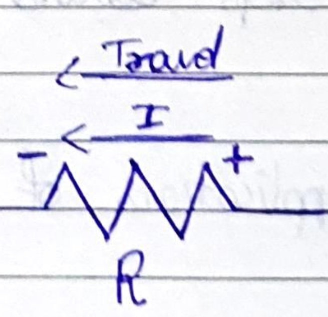


$\Rightarrow -E$

(b) **For resistor:-**



$\Rightarrow +IR$



$\Rightarrow -IR$

* Faraday's Laws of Electromagnetic Induction.

- Consists of 2 Laws:-
- **1st Law:-** Whenever a conductor is placed in a varying M.F, an emf is induced. If conductor circuit is closed, a current is induced which is called induced current.
- **2nd Law:-** The induced emf in a coil is equal to the rate of change of flux linkage.

*** Transformers:-** is working on principle of electromagnetic induction i.e. when current in 1 circuit changes, an induced current is set up in neighbouring circuit.

- Consists of 2 coils ⟹ primary & secondary.
- To avoid eddy currents ⟹ core is laminated.
- In Step-~~up~~ down ⟹ Many turns having on primary coil
  ⟹ few turns on secondary coil.
- Step-~~down~~ up ⟹ few turns on primary coil.
  ⟹ Many turns on secondary coil.

⟹ Applications of Single-phase transformer ⟹ television sets to regulate voltage
⟹ low voltage electronic devices
⟹ Step-up power in home inverter

- $I = \frac{V}{Z}$
- $Z = \sqrt{R^2 + (X_L - X_C)^2}$
- DC circuit ⇒ product of voltage & current ⇒ power.
- AC circuit ⇒ product of RMS value of voltage & current gives Volt-Ampere & true power. ⇒ apparent power.
- Apparent power ⇒ 2 components ⇒ ① True power/ Active power ② Reactive power.

* **In single phase a.c. system:-**

① True power $P = VI\cos\phi$ (watts)
② Reactive power $P = VI\sin\phi$ (VAR)
③ Apparent power $P_a = V.I.$
$= (V.I\cos\phi) + j(V.I\sin\phi)$

* **In three phase a.c. system:-**

① True power $P = \sqrt{3}V_L I_L\cos\phi$ (watts)
$= \sqrt{3}V_p I_p\cos\phi$ (watts)

- Wattmeter ⇒ measure electrical power.

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• Wattmeter consists of 2 coils :-

① Current coil (CC) :- → connected in series of load
→ carries full load current.
→ very low resistance
→ few no. of turns of thick conductor

② Potential coil (PC) :- → connected in parallel of load
(Pressure coil) → high resistance
→ large no. of turns of thin conductor.

⇒ 3-phase have 3 system:-

① 1 wattmeter method → Total power is 3 time of that measured by single wattmeter
② 2 wattmeter method → TP is sum of 2 WM, both for balanced / unbalanced
③ 3 wattmeter method → Algebric sum of 3 WM will give Total power.

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* Gates :-

IC 7408

① AND → $Y = A.B$ [Both ~~out~~ input is high (1) then output is high]

IC 7432

② OR → $Y = A+B$ [Both input is low (0) then output is low]

IC 7404

③ NOT → $Y = \bar{A}$ [produces complement of its input] [INVERTER]

IC 7400

④ NAND → $Y = \overline{A.B}$ [Both input is high (1) then output is low (0)]

IC 7402

⑤ NOR → $Y = \overline{A+B}$ [Both input is low (0) then out put is high (1)]

⇒ Universal Gate ⇒ NAND & NOR

⇒ create any logical Boolean expression using only NOR or only NAND gates.

IC 7486

⑥ Exclusive OR (X-OR) → $Y = A \oplus B \Rightarrow \bar{A}B + A\bar{B}$

⇒ [When no. of 1's at its inputs is odd, out put is 1]

⇒ [Same input ⇒ output low]

IC 74266

⑦ Exclusive NOR (X-NOR) → $Y = A \odot B \Rightarrow \bar{A}\bar{B} + AB$

⇒ [When no. 1's at its input is not odd, output is 1

⇒ [Same input ⇒ output high]

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- Diodes → 2 terminal devices having 2 diff-types of semiconductors joined to together forming only a single junction.

- Transistor → 3 terminal device — } Base, collector, emitter.

Transistor → BJT, FET

BJT
Bipolar Junc. Trans.

FET → Field Effect Trans.

① SR-Flip Flop ② Delay Flip Flop ③ J-K Flip Flop ③ T Flip Flop