Basic Machine

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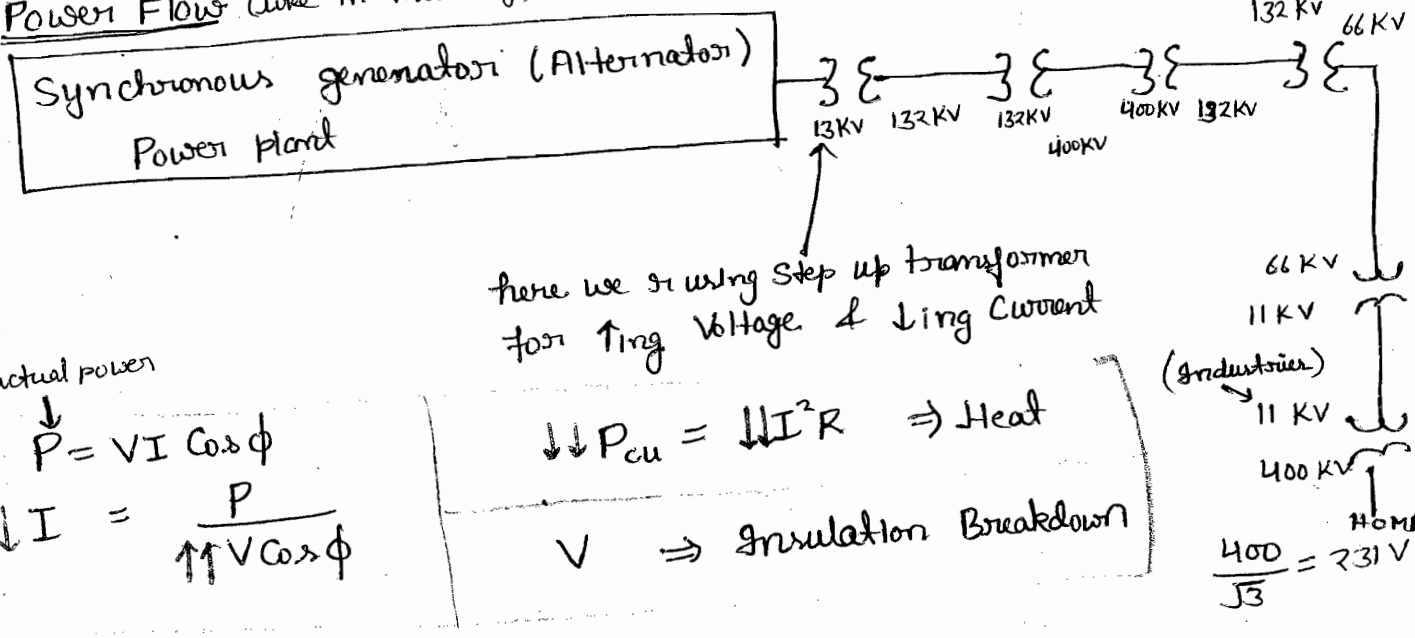
- Industries requires line Voltage i.e around 11 KV
  Generator can generate upto 13KV only becoz of insulatn problem

- Power Flow (like in this way)



actual power

$P = VI\cos\phi$

$I = \frac{P}{V\cos\phi}$

$P_{cu} = I^2R \Rightarrow$ Heat

$V \Rightarrow$ Insulation Breakdown

we ↑ volt becoz we need to ↓ I.

Cu loss → During flow of e⁻s, Collision occurs & due to Collision energy released or dissipate i.e called Cu loss

Syllabus

Basics of electromagnetism

DC m/c

Transformer → Basics of AC (3ϕ)

- Induction M/C
- Synchronous M/C — (Imp topics) Constn, Num EMF, Synch. Impedance (Z_s), A.R, eqn ckt + phasor, change in excitatn (V-Curve & Inverted V-Curve), Voltage regulatn (Num) ($\frac{E \pm V}{V}$)
- → Power Plants
- Batteries

① Basics of Electromagnetism

- Here we study about Magnetic flux.

Magnet

Fe_3O_4 ⇒ Magnetite

Magnet

- Not usable → Natural Magnet (weaker) (how we make it) (By rubbing Iron on magnet)
- Mostly usable → Artificial magnet (Passing electric current wound on the magnetic Material)

Artificial Magnet

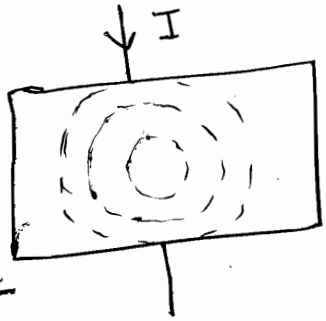
- Parmanent magnet (These hv more retentivity) → Its magnetic Strength is very high which we can't control
  - → AINICO
  - → used in
    - Head phones
    - Small dc M/c

- Temporary magnet
  - Easily Magnetised & demagnetised
  - Soft Iron
  - used in Generator, Transformer etc

. If we give I then movement will occur e.g motor, Fan
. If we move mgnet then I will induce e.g. generator.
. we need 4 things Magnet, Magnetic liner, I, Movement.

Magnetic field around a Current Carrying Conductor

Hans Christian Oersted 1820, oersted



Conclusion

① Electric wire having magnetic field around it which depends upon strength of 'I'

② Direct^n of Current & ③ the magnetic induct^n is circular in nature

④ If Spacing b/w the magnetic induction ↓es as we

move closure to the Current Carrying Conductor.

Fundamental Pt:

2(i) Flux → Magnetic lines of forces (~~real~~) (assumed by Faraday)
(ϕ)

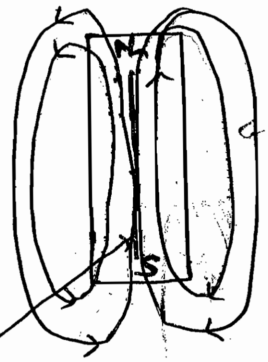
(ii) B

Both are Vector

Scalar

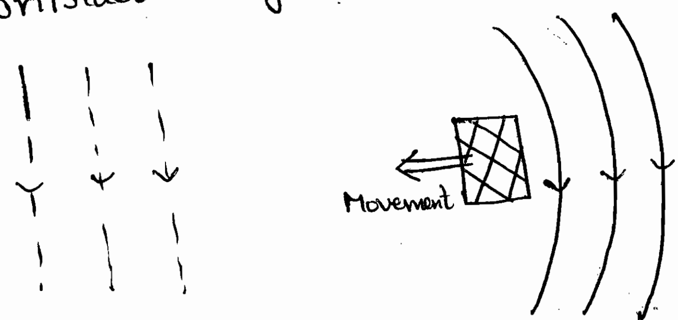
$$\phi = \vec{B} \cdot \vec{ds}$$

$\phi = B \cdot ds \cos\theta \Rightarrow B = \dfrac{\phi}{ds \cos\theta}$



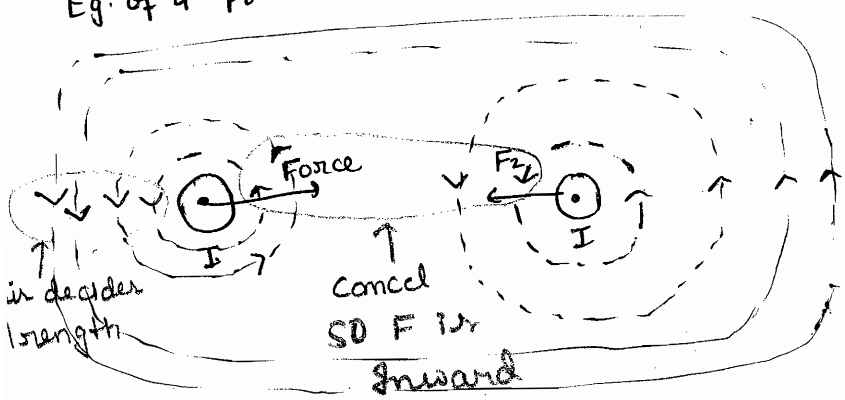
Lines of Magnetic Flux

1) Form Closed loop
2) Always start from north pole & end in the south pole & are then Continues through the body of the magnet
3) They never intersect each other.
4) Lines of forces are like stretched elastic chords tending to Contract length wise

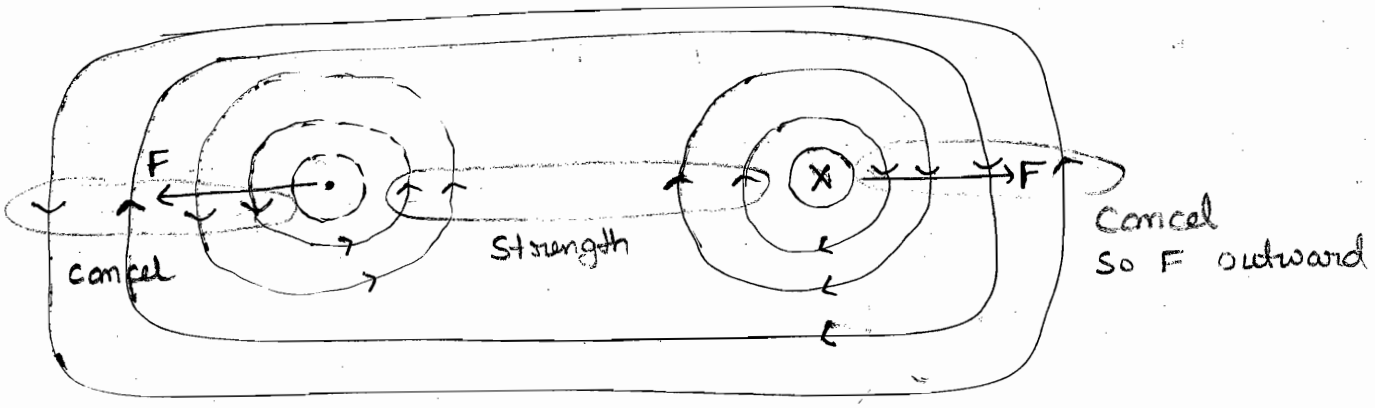


5) Parallel & in the same directⁿ, repel each other

Eg. of 4th pt

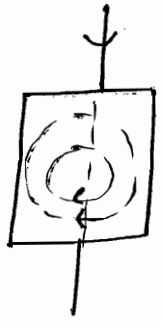


That's why 2 Current Carrying Conductors experience either attractive or Repulsive forces

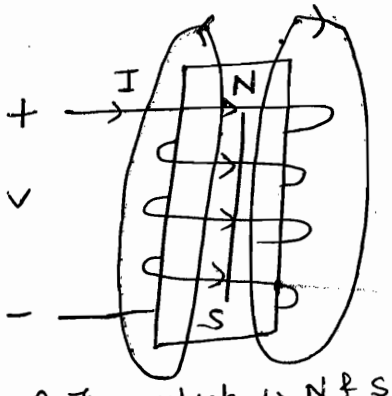


Q How to decide the direct^{n} of 'I'

A Put the thumb in the dir^{n} of I & decide direct^{n} of I
of R.Thumb

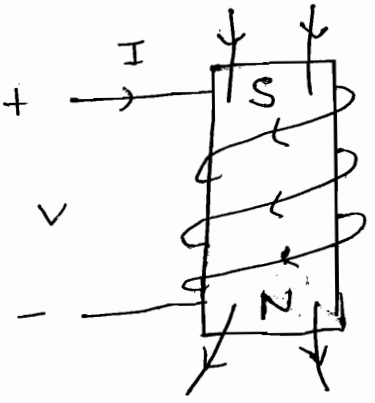


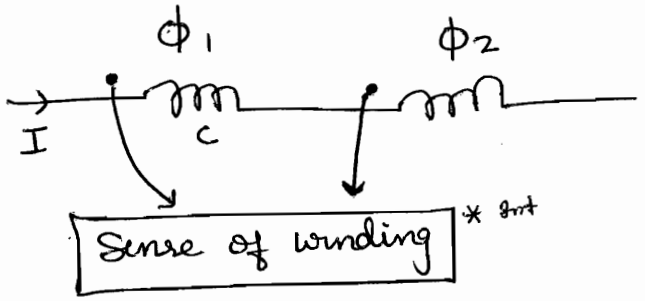
Q direct^{n} of I



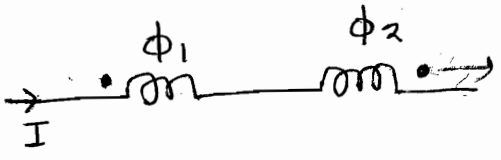
Q Then which is N & S

A The 'I' entering side is N & Leaving side is 'S'





$\phi_{total} = \phi_1 + \phi_2$



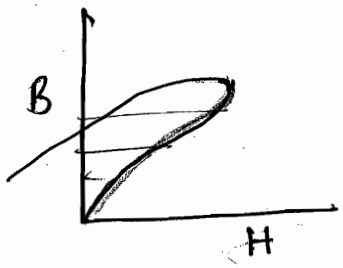
$\phi_{total} = \phi_1 - \phi_2$

- S Pole - If Flux go inside

- N Pole – If flux come Outside

Q what is μ & will value of μ vary in same material

Basic written



μ = Permeability $\Rightarrow B = \mu H$

$Y = mx$

m is slope so μ is equivalent to μ. & here slope is varying so μ (Permeability) will vary. with B

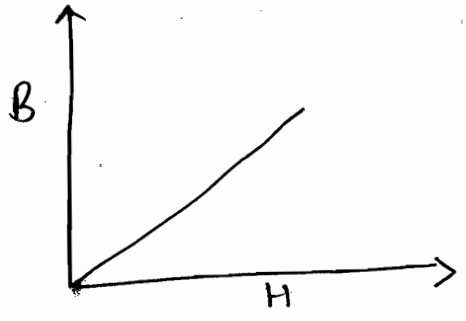
for Non- magnetic material μ is same

$\mu = \mu_0 \mu_r$

where, $\mu_0 = 4\pi \times 10^{-7}$ H/m ← Permability for non-magnetic material

↳ Fixed

B-H Curve for air / Non-magnetic Material



$\mu = \mu_0 = 4\pi \times 10^{-7}$ H/m

What is Reluctance

$$S = \frac{l}{\mu a}$$

↓

B

↓

ϕ

$$R = \rho \frac{l}{a}$$

$$= \frac{1}{\sigma} \frac{l}{a} \rightarrow \text{Reluctance}$$

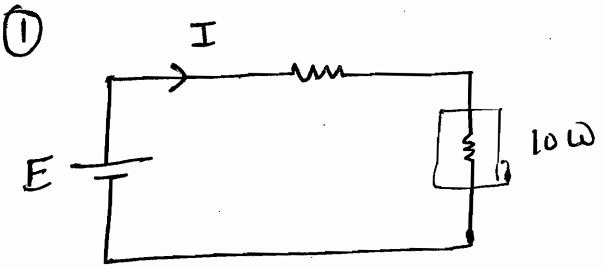
In Current, there is Resistance & In Magnet, there is Reluctance

Reluctance → Opposition offered to the passage of magnetic flux through a magnetic material.

- If there will be no MMF then flux will also be not be there
- " " " " " EMF " I " " " " " "
- Mean length is avg length which is taken from mid

Electric ckt	Magnetic ckt

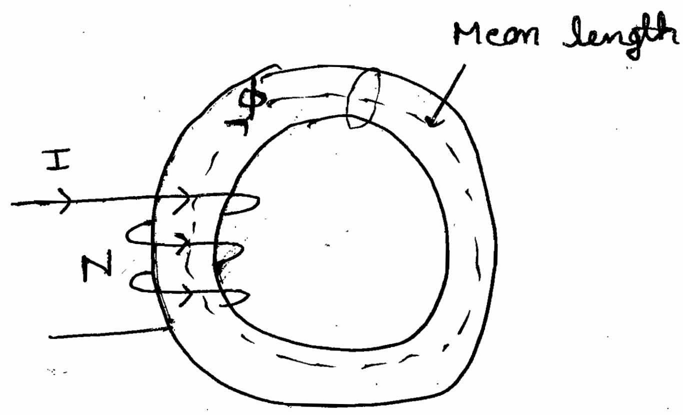
①



E (cause) ⇒ Current (I)
EMF

$$I = \frac{E}{R + R_{10\omega}}$$

here as we inc. EMF, then we can ↑ I



MMF = NI
Cause ⟶ Flux φ

Reluctance → $$S = \frac{l}{\mu a}$$

l = Mean length of Magnetic ckt

$$\phi = \frac{MMF}{S}$$ (Magneto motive force)

here as we ↑es no. of turns then φ ↑es.

②

E ⟷ MMF

Reactive Power :- Is a medium, or chnl,

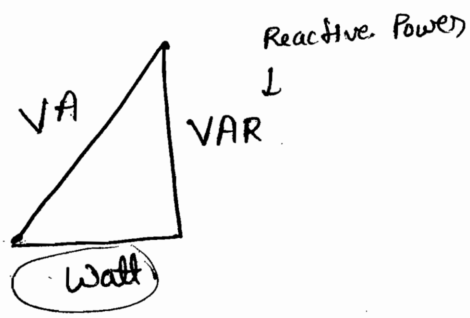
I ⟷ φ

R ⟷ S

V ⟷ X

↑ Difference b/w electric & Magnetic ckt starts form here

Eg. 500 (go to Mall)
- 100 (required for executⁿ)
- 400 (purchase items)



water
P.E
mgH (J or watts) ⟶ House (Energy meter) ⇒ watts

(P) ↓ watts

VICosφ → Active Power
↓
watts

- we prefer that system which requires less reactive power

Eg. Rs 500 (Total)
- 100 (Reactive Power) (require for execut^n) ✓
- 400 (Active Power) (Purchasing)

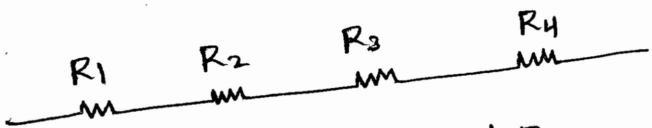
good becoz requires less Reactive Power

500
- 200 Require for execut^n
- 300 Purchasing

X bad

EMF

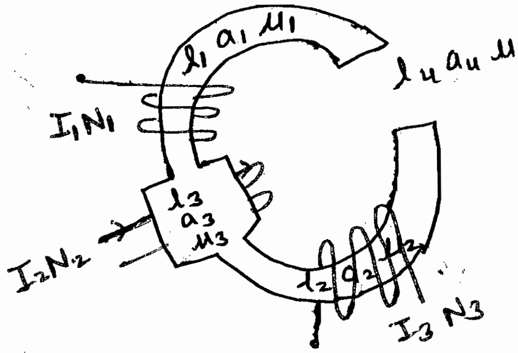
$$E = V_1 + V_2 + \ldots + V_n$$



$$R_{eq} = R_1 + R_2 + R_3 + R_4$$

MMF

$$F_{Total} = F_1 + F_2 + \ldots + F_n$$



MMF

$$F_T = I_1N_1 + I_2N_2 + I_3N_3$$

$$S = S_1 + S_2 + S_3 + (S_4)_{airgaps}$$

check ?

$$S_{resultant} = \frac{l_1}{\mu_1 a_1} + \frac{l_2}{\mu_2 a_2} + \frac{l_3}{\mu_3 a_3} + \frac{l_4}{\mu_4 a_4}$$

$$\phi_{Total} = \frac{MMF}{S} = \frac{I_1N_1 + I_2N_2 + I_3N_3}{S_{resultant}}$$