Magneto Motive Force (MMF):-

"The work done to carry a magnetic pole from one point to another point is called as MMF". In simple words, MMF is required to drive the magnetic flux in the magnetic circuit.

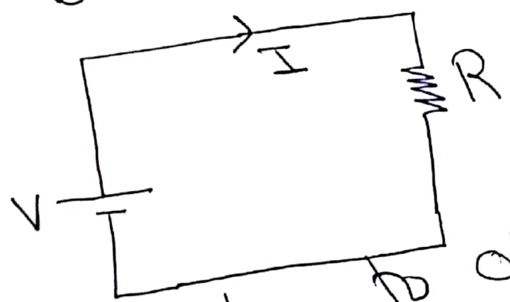
Mathematically:-

$$MMF = NI$$

- Its unit is Ampere-turns (AT).

Reluctance (S):-

Suppose we have a simple electrical circuit as shown below:-



- then according to ohm's low:-

$$I = \frac{V}{R}$$

In case of magnetic circuit.

I → flux

V → mmf

R → Relectance.

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"Reluctance is the measure of opposition offered by the magnetic circuit to the setting of magnetic flux".

mathematically:-

$$S = \frac{MMF}{Flux}$$

$$S = \frac{NI}{Flux}$$

Its unit is AT/wb

As we know that in case of electrical ckt:-

$$R = \frac{\rho L}{A}$$ where ρ = Resistivity

or $$R = \frac{L}{\sigma A}$$ where σ = conductivity

In case of magnetic ckt, conductivity is analogous to permeability:-

$$\boxed{S = \frac{L}{\mu A}}$$

$$\boxed{S = \frac{L}{\mu_0 \mu_r A}}$$ $\left(\mu_r = \frac{\mu}{\mu_0} \quad \mu = \mu_r \mu_0 \right)$

→ As we know that reciprocal of resistance is conductance.

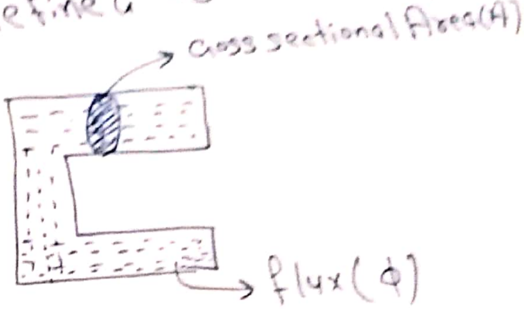
→ The reciprocal of Reluctance is permeance.

$$\text{Permeance} = \frac{1}{S}$$

$$\boxed{\text{permence} = \frac{\mu_0 \mu_r A}{L}}$$

Magnetic Flux Density:-

magnetic Flux density can be defined as "Flux per unit area" i.e



$$B = \frac{\phi}{A}$$

Where B = Flux Density

ϕ = Cross Sectional Area.

A = cross Sectional Area.

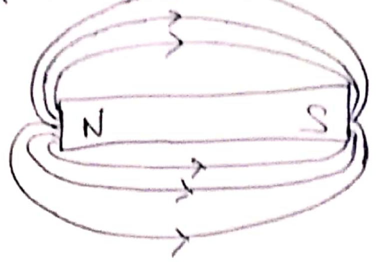
From the above Relationship, it is clear that Flux density is directly proportional to flux and invesly proportional to cross-sectional area.

Its unit is:-

$$B = \frac{\phi}{A} = \frac{wb}{m^2} \text{ or Tesla (T)}$$

Magnetic Field Strength (H):-

"magnetic field strength is the measure of strength or the weakness of the magnetic field"



Suppose we have a piece of iron near a magnet as shown above. Then this material will experience a little force from the magnet. So we can say that (H) is less. If we bring it closer to the magnet. The force will be more and hence we can say that (H) is more.

mathematically:-

$$H = \frac{MMF}{L} \quad (\text{i.e } MMF \text{ per unit length})$$

$$H = \frac{NI}{L}$$

- It units is AT/m

The relation b/w B & H is shown below:

As:- $\phi = \frac{MMF}{S} = \frac{NI}{S}$

$$\phi = \frac{NI \mu_o \mu_r A}{L}$$

$$\frac{\phi}{A} = \frac{NI \mu_o \mu_r}{L}$$

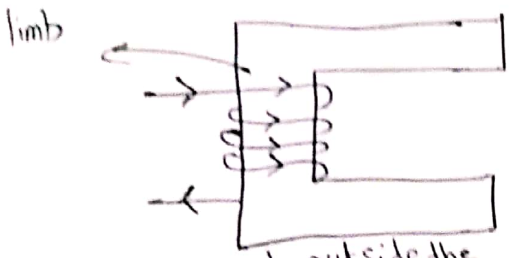
$$B = \left(\frac{NI}{L}\right) \mu_o \mu_r$$

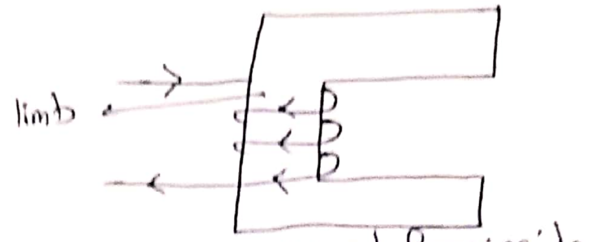
$$\boxed{B = \mu_o \mu_r H}$$

or $\boxed{B = \mu H}$

→ The magnetic field around a current carrying conductor can be found by right hand thumb rule.

Thumb → Indicates direction of flux.
Curled fingers → Direction of current.





Wire wound outside the limb

Wire wound from inside.

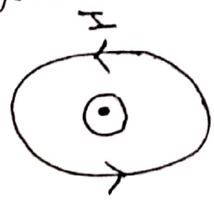
• → In this case, direction of flux will be upward

→ In this case, direction of flux will be downward.

→ current entering into a conductor is represented by ⊗ and current leaving a conductor is represented by ⊙.

• Suppose we have a vertical wire, then in this case, thumb will indicate the direction of current, while curled finger will indicate the direction flux.

→ Suppose we have a circular wire.



→ In this case.
curled fingers = current
thumb = flux (coming outwards hence indicated by ⊙)

→

→ Flux = entering (represented by thumb).