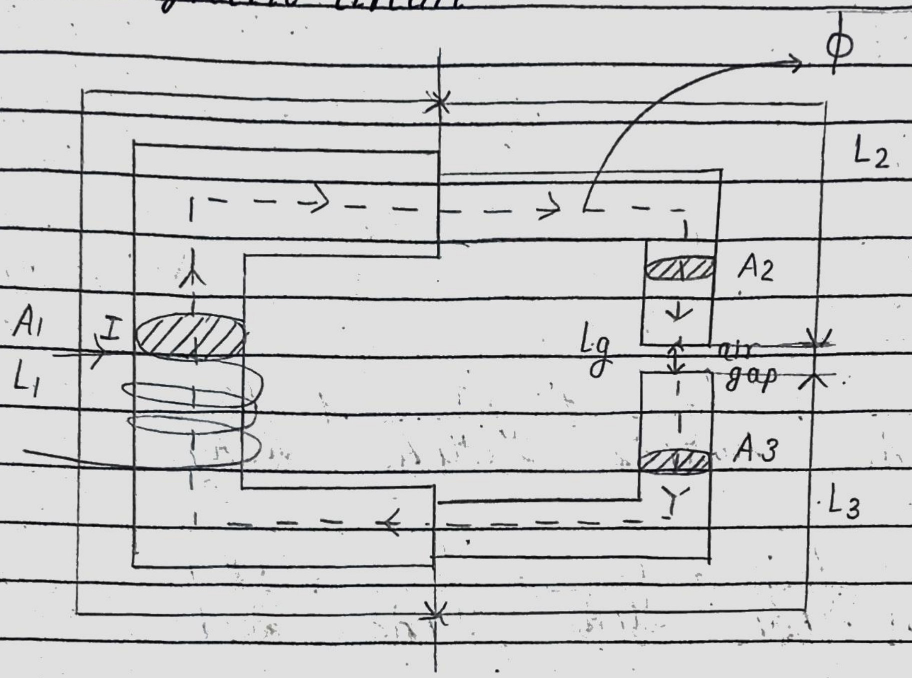
Types of magnetic circuit

i series magnetic circuit



Series magnetic circuit is the magnetic circuit in which same magnetic flux passes through all section of the magnetic circuit.

we know that,

$$\phi = \frac{mmf}{S}$$

$$\phi = \frac{NI}{S_T}$$

as per the circuit,

$$S_T = S_1 + S_2 + S_3 + S_g$$

we know,

$$S = \frac{L}{\mu_0 \mu_r A}$$

$$S_1 = \frac{L_1}{\mu_0 \mu_r A_1}$$

$$S_2 = \frac{L_2}{\mu_0 \mu_r A_2}$$

$$S_3 = \frac{L_3}{\mu_0 \mu_r A_3}$$

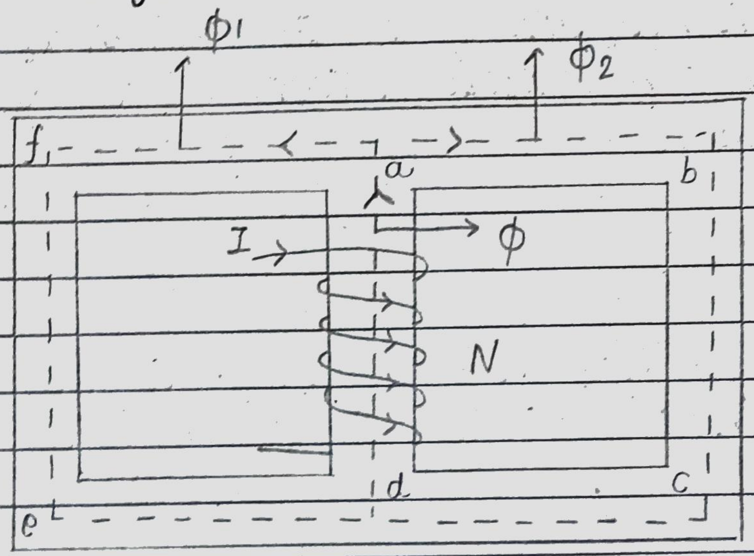
$$S_g = \frac{L_g}{\mu_0 A_g}$$

then,

$$S_T = \frac{L_1}{\mu_0 \mu_r A_1} + \frac{L_2}{\mu_0 \mu_r A_2} + \frac{L_3}{\mu_0 \mu_r A_3} + \frac{L_g}{\mu_0 A_g}$$

$$\therefore S_T = \frac{1}{\mu_0}\left[\frac{L_1}{\mu_r A_1} + \frac{L_2}{\mu_r A_2} + \frac{L_3}{\mu_r A_3} + \frac{L_g}{A_g}\right]$$

ii parallel magnetic circuit



$$\phi = \phi_1 + \phi_2$$

The magnetic circuit in which magnetic flux divides into two or more parallel path, then such magnetic circuit is known as parallel magnetic circuit.

The total flux(ϕ) is equal to the sum of ϕ_1 and ϕ_2
i.e

$$\phi = \phi_1 + \phi_2$$

Consider a coil having N turns is wound on the portion ad as shown in figure through which current I is flowing. The flux set up by the mmf $\xi \phi$, divides into two paths at point a.

Flux ϕ_1 passes along afed and flux ϕ_2 passes along abcd.

Therefore, the path abcd and afed are parallel and form the parallel magnetic circuit.

The ampere turn or mmf required for this parallel circuit is equal to the ampere turn required for any one path.

Therefore, total ampere turn required is equal to ampere turn required for common path ad summed with ampere turn required for either one path i.e either abcd or aefd.

i.e

$$AT_{total} = AT_{ad} + AT_{abcd}$$

OR

$$AT_{total} = AT_{ad} + AT_{afed}$$

Date
Page

Faradays law of electromagnetic induction

i) First law

Whenever a flux linked with a coil changes, an emf is induced.
In other words, whenever a current carrying conductor is placed in the magnetic field, an emf is induced.

ii) Second law

The magnitude of induced emf is directly proportional to the rate of change of flux.
Mathematically,

$$E \propto \frac{d\phi}{dt}$$

$$E = +N\frac{d\phi}{dt}$$

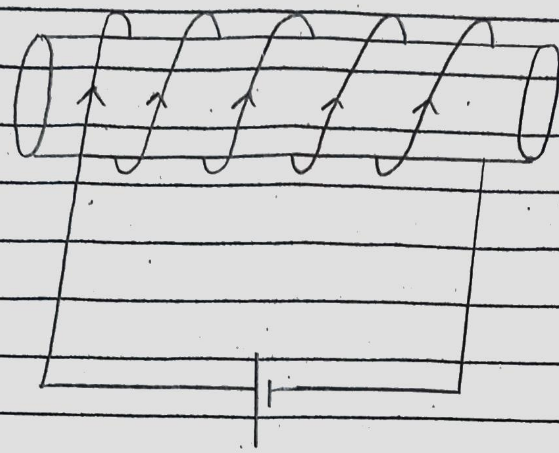
Lenz's law:

According to this law, the direction of induced emf is such that it opposses the cause producing it.
By taking Lenz's law into account, the induced emf becomes,

$$E = -N\frac{d\phi}{dt}$$

The emf can be induced in two ways:

i) Statically induced Emf



The emf induced when there is no relative motion between the conductor and magnetic field, then it is known as statically induced emf.
In this method, the emf is induced by increasing or decreasing the value of current.
It is of two types:
- Self induced emf
- Mutually induced emf