NOTES Class 40

Generation of Balanced Three Phase EMFs:

A balanced three phase system of EMFs is a set of three EMFs which are equal in amplitude (or) magnitude and displaced in phase from one another by 120°.

For instance,

$e_1(t) = E_m \sin(\omega t)$

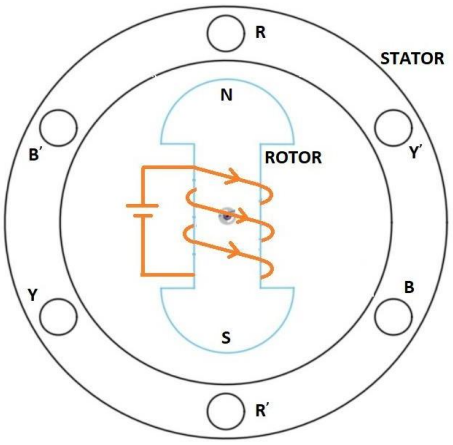
$e_2(t) = E_m \sin(\omega t - 120°)$

$e_3(t) = E_m \sin(\omega t - 240°)$

represent balanced three phase system of EMFs.

A balanced three phase system of EMFs is generated in a machine called 'Three Phase Generator', also called 'Alternator'.

Three Phase Generator (or) Alternator – Construction:

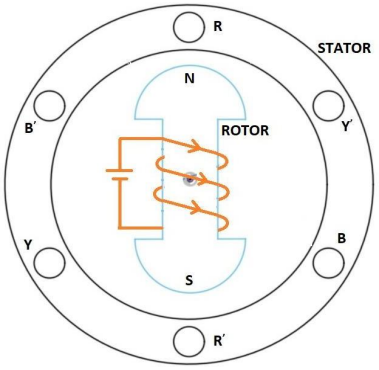


The **'Stator'** which is the stationary member consists of three coils R, Y & B which are physically displaced from one another by 120°. The **'Rotor'** which is

the rotating member consists of set of electromagnets excited by a field winding connected to a DC supply. The shaft of the rotor is coupled to a prime mover such as steam turbine (or) hydro turbine (or) Diesel engine.

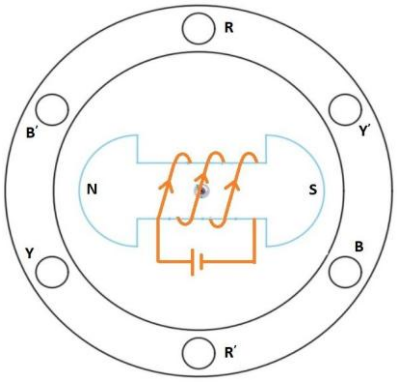
Principle of Operation:

Let us consider Position 1: Coil R facing centre of North Pole



In this position, R-coil will have maximum rate of change of flux linkages hence, maximum positive EMF is induced in it in this position.

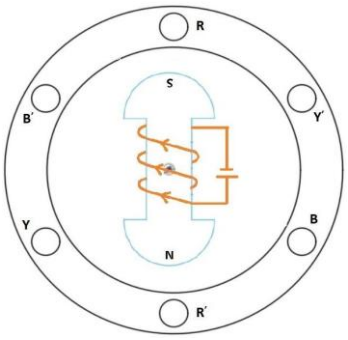
Let us consider Position 2: Coil R facing interpolar axis



In this position, R-coil will have minimum rate of change of flux linkages hence, Zero EMF is induced in it in this position.

Let us consider Position 3: Coil R facing centre of South Pole

In this position, R-coil will have maximum rate of change of flux linkages and since facing south pole, will have maximum negative EMF induced in it.



As rotor completes one revolution, one cycle of sinusoidal EMF is induced in R – coil. In Y – coil, another sinusoidal EMF is induced which has same amplitude and frequency as that in R – coil but it lags R – coil EMF by 120°. Similarly in B – coil, another sinusoidal EMF is induced which has same amplitude and frequency as that in R – coil but it lags R – coil EMF by 240°.

Thus, As rotor completes one revolution, balanced three phase system of EMFs are generated in the three coils placed in the stator.

Phase Sequence:

Phase Sequence of a Three Phase System is defined as the sequence in which the three phase EMFs attain peak value. Usual phase sequence is RYB.