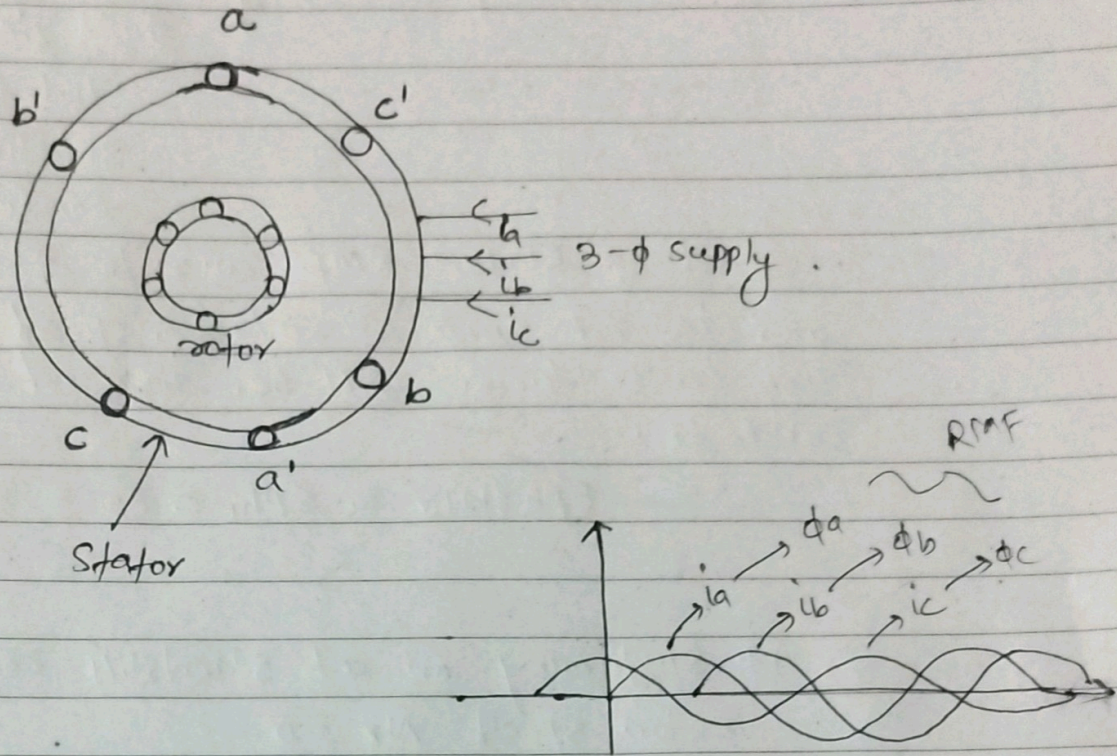


## 3- $\phi$ Induction motor

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$\Rightarrow$  3- $\phi$  supply given to stator winding

$\downarrow$   
RMF (rotating magnetic field)

$\downarrow$   
3- $\phi$  magnetic field which rotating with a speed corresponding to stator supply frequency, 
$$n_s = \frac{120f}{p}$$

where,

$f$  = supply frequency

$p$  = no of poles.

$n_s$  = synchronous speed (constant speed)



$\Rightarrow$  Stator winding stationary  $\rightarrow$  having rotating magnetic field (RMF) around it and hence there will be relative motion between conductor and RMF.

Speed of stator RMF w.r to stator body  $\rightarrow (N_s - 0 = N_s)$  and induced emf  $\propto$  relative speed and hence there will be induced emf in stator conductor.

$$E_{ph \text{ stator}} = E_{ph1} = E_2 = 4.44 f \phi N_1$$

$\Rightarrow$  At stationary or at standstill condition of rotor, rotor speed  $N_r = 0$

Hence the rotor conductor (winding) will also experience the cutting of stator RMF field.

Speed of RMF stator w.r to rotor  $= N_s - 0 = N_s$  and hence induced emf  $\propto$  relative speed.

$$E_{ph \text{ rotor}} = E_{ph2} = E_2 = 4.44 f \phi N_2$$

$\Rightarrow$  Due to this emf at standstill condition, there will be a rotor current as rotor circuit is a closed circuit.

$$I_r \text{ standstill} = \frac{E_{ph2}}{Z_r} = \frac{E_2}{Z_r}$$

$\Rightarrow$  Hence, when current will flow in the rotor conductor which will also produce mmf



in such a direction that it opposes its cause and this mmf interact with stator mmf in air gap and produce torque on rotor body (Electromagnetic torque).

Effect Torque production	Cause $\downarrow I_r \rightarrow \downarrow E_{ph_2} \rightarrow$ due to relative motion $\downarrow (N_s - 0)$ $\downarrow$ $\downarrow (N_s - N_r)$ $\downarrow$ Speed of RMF $\uparrow$ speed of rotor
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Now the rotor will start rotation in clockwise direction to oppose its cause and try to catch up the stator RMF speed  $N_s$ .

$\Rightarrow$  Hence, 3- $\phi$  induction motor is a self starting.