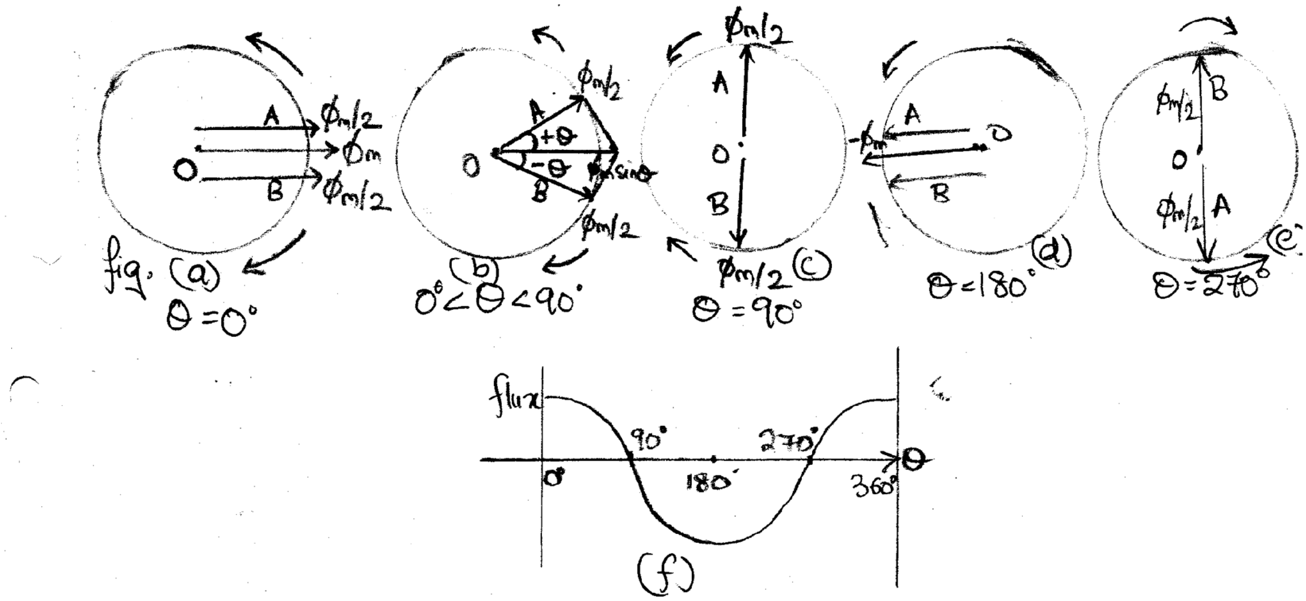
KUNAL / ABHISHEK

Q9 Explain double field revolving theory. How is 1ϕ induction motor made self starting. [8]

Ans. According to double field revolving theory, an alternating uniaxial quantity can be represented by two oppositely rotating vectors of half magnitude.

Thus an alternating sinusoidal flux can be represented by two revolving fluxes, each equal to half the value of the alternating flux and each rotating in opposite direction.



Consider an alternating flux having maximum value ϕ_m.

Fig(a), according to double field revolving theory ϕ_m can be resolved into two components $\phi_m/2$ revolving in opposite directions.

Fig(b), after sometime A & B have rotated through an angle θ. Hence the resultant would be $2\,\phi_m/2 \sin\theta = \phi_m \sin\theta$.

Fig(c), when $\theta = 90°$, fluxes A & B are oppositely directed, hence the resultant is zero.

Fig(d), when $\theta = 180°$, the resultant is $-2\,\phi_m/_2 = -\phi_m$.
Fig(e), when $\theta = 270°$, fluxes A & B are oppositely directed hence the resultant is zero.

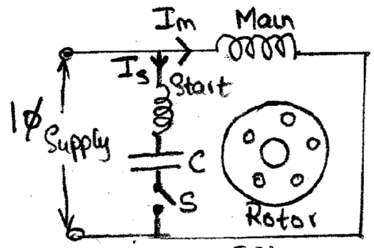
Thus an alternating flux can be looked upon as composed of two revolving fluxes each of half the value and revolving synchronously in opposite directions.

Fig(e), shows the plot of the resultant flux against θ when $0° \leq \theta \leq 360°$

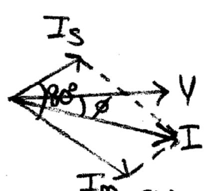
Since a 1ϕ induction motor is not self-starting, hence to overcome this drawback and make the motor self-starting, it is temporiarily converted into a two phase motor during starting period. For this purpose, the stator of a single-phase motor is provided with an extra winding known as starting winding in addition to main or running winding. The two windings are spaced 90° electrically apart and connected in parallel across the single phase supply as in fig(i)

The phase difference between the currents in two windings is very large (ideal 90°) hence the motor behaves like a two-phase motor. These two currents produce a revolving flux and make the motor self-starting.

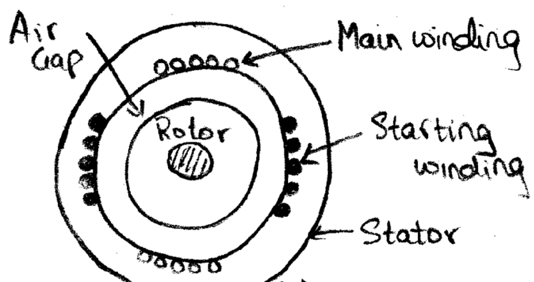
This can be acheived by using capacitor-start induction-run motor.



(g)



(h)



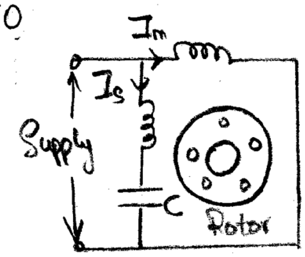
(i)

** In, these motors, the necessary phase difference between I_s and I_m is produced by connecting a capacitor in series with the starting winding as in fig (g). When the motor reaches about 75% of full speed, the switch S opens and cuts out both the starting winding and capacitor from the supply, thus leaving only the running winding across the lines.

** fig(h). current I_m drawn by mains lags supply voltage V by large angle while I_s leads V by certain angle. The two currents are out of phase with each other by about 80°

Q10 Explain capacitor start and run motor. [6]

Ans 10



Graph fig Q9(h)

Description - Q9 (last two para's **) ~~add~~ exclude switch S & add:-
The capacitor C is connected in circuit at all times.
This gives (i) Higher efficiency (ii) Higher power factor (iii) Improves overload capacity and (iv) quieter running of motor.

Q11 Why is 1Ø induction motor not self starting [3]

Ans 11 When a 1Ø induction motor is fed from a single-phase supply, its stator winding produces a flux which is only alternating. An alternating flux on a stationary squirrel-cage rotor cannot produce rotation as it is not a revolving flux. Hence it is not self starting.