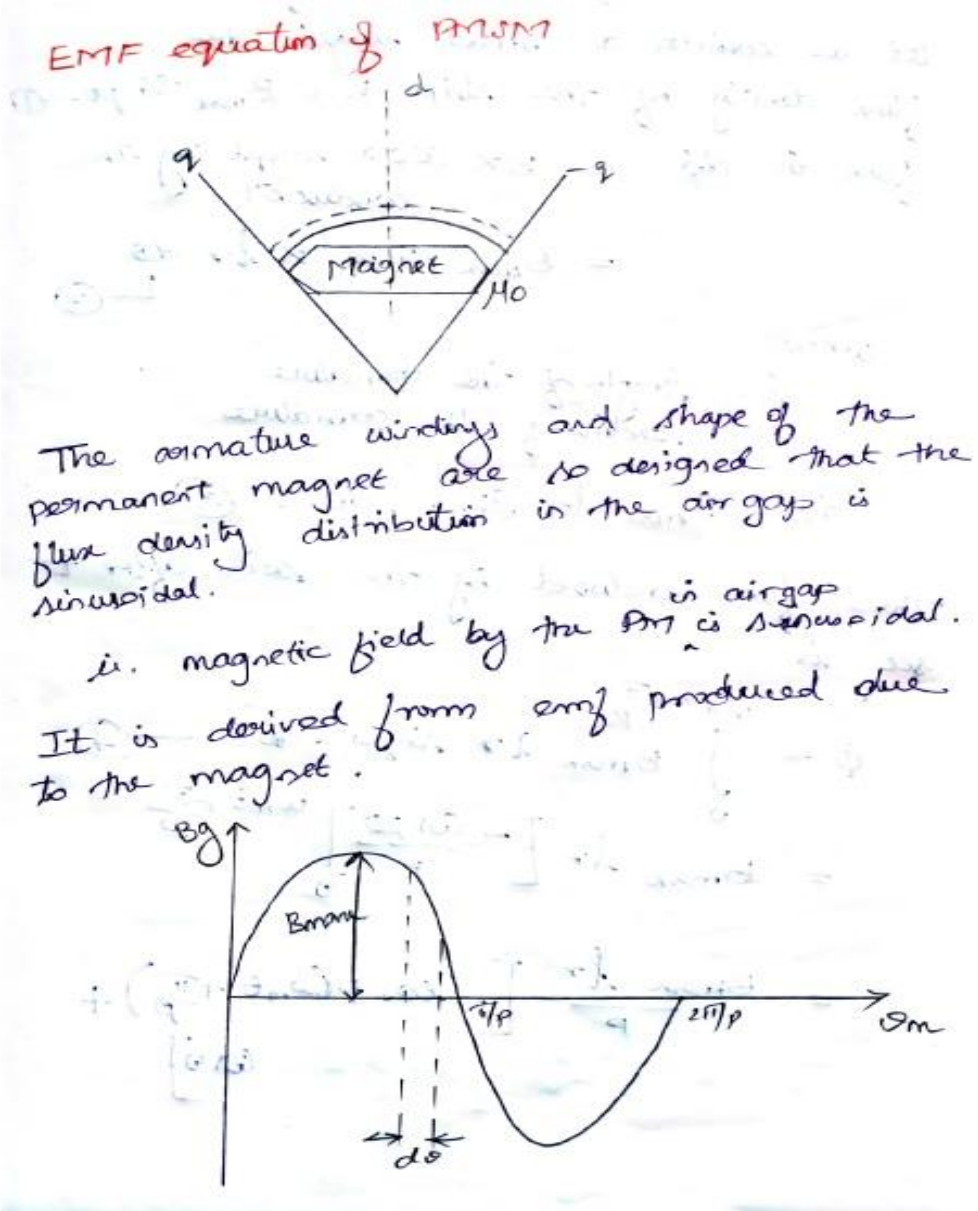

UNIT – 2

PERMANENT MAGNET SYNCHRONOUS MOTOR

EMF EQUATION



where B = flux density

P : no. of pole

θ = angle (or) position of rotor

Let us consider a small angle dθ

flux density of the strip $B = B_{max} \sin p\theta$ — (1)

flux in $d\phi$ = B × area swept by the conductor

$= B_{max} \sin p\theta \times l r \, d\theta$ — (2)

where

l = length of the armature

r = radius of the armature

$d\phi = B_{max} l r \sin p\theta \, . \, d\theta$ — (3)

The flux enclosed by the coil after t sec is

$$\phi = \int_0^{\omega_m t + \frac{\pi}{p}} B_{max} l r \sin p\theta \, . \, d\theta \quad \text{— (4)}$$

$$= B_{max} l r \left[-\frac{\cos p\theta}{p} \right]_0^{\omega_m t + \frac{\pi}{p}}$$

$$= \frac{B_{max} l r}{p} \left[-\cos p\left(\omega_m t + \frac{\pi}{p}\right) + \cos 0 \right]$$

$$= \frac{B_{max} \pi r}{p} \left[-\cos p \left(\omega_m t_p + \frac{\pi}{p} \right) + \cos 0 \right]$$

$$= \frac{B_{max} rl}{p} \left[-\cos p\omega_m t \cos \pi + \cos 0 \right]$$

$$= \frac{B_{max} rl}{p} \left[-\cos p\omega_m t + 1 + 1 \right]$$

$$\phi = 2 \frac{B_{max} lr}{p} (-\cos p\omega_m t) \quad \text{---} \quad (5)$$

Faradays law of electromagnetic induction

$$e = -\frac{d\phi}{dt} = -\frac{d}{dt} \left[2 \frac{B_{max} rl}{p} \cos p\omega_m t \right] \quad \text{---} \quad (6)$$

$$= 2 \frac{B_{max} rl}{p} \times p\omega_m \sin p\omega_m t$$

$$e = 2 B_{max} rl \omega_m \sin p\omega_m t \quad \text{---} \quad (7)$$

$$e_{ph} = (2 B_{max} rl \omega_m \sin p\omega_m t) T_{ph}$$

$$= E_{ph} \sin p\omega_m t \quad [\because E_{ph} = 2 B_{max} rl \omega_m] \quad \text{---} \quad (8)$$