SNS COLLEGE OF ENGINEERING

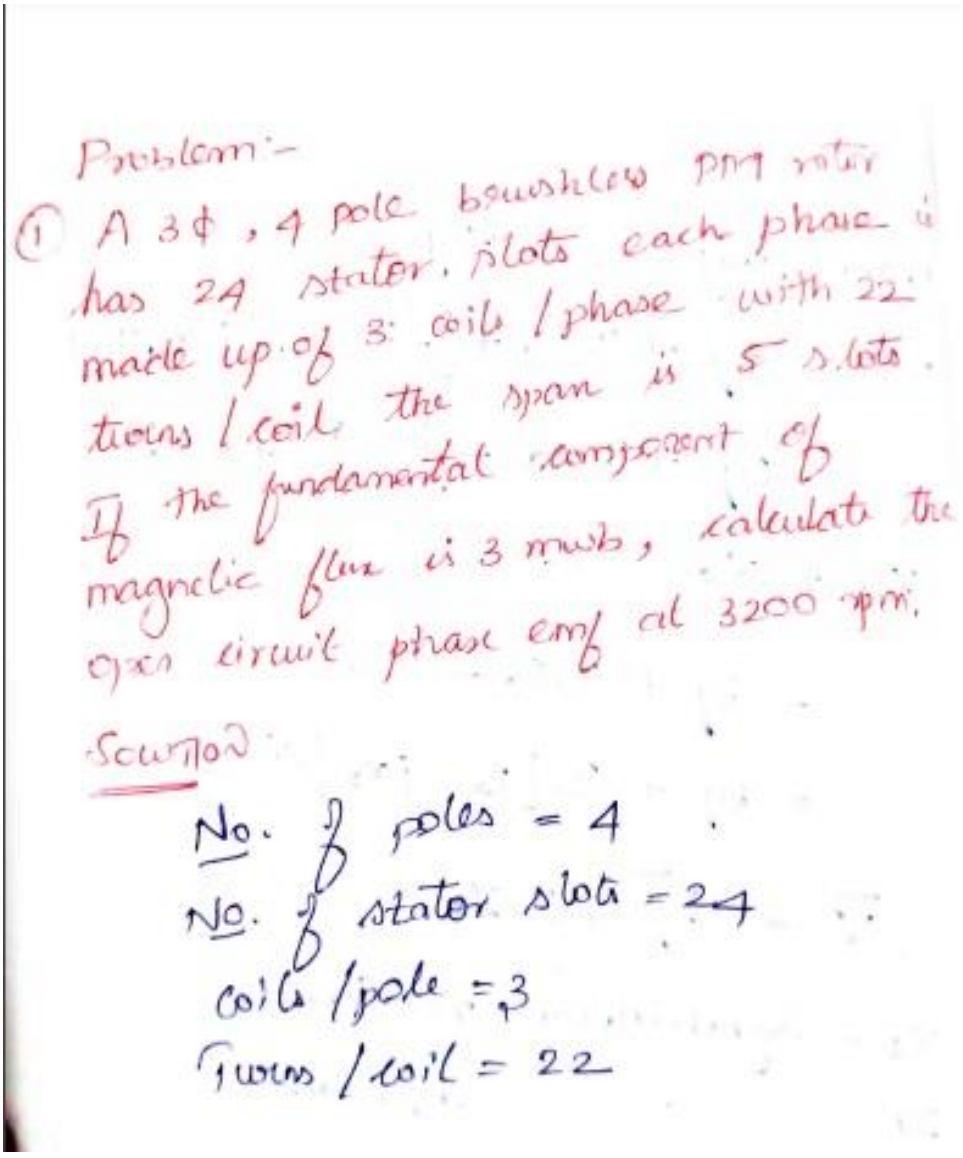
Kurumbapalayam (Po), Coimbatore – 641 107

AN AUTONOMOUS INSTITUTION

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

POWER SYSTEM ANALYSIS
UNIT – II
PERMANENT MAGNET SYNCHRONOUS MOTOR
PROBLEM



Problem:-

(1) A 3φ, 4 pole brushless PM rotor has 24 stator slots each phase is made up of 3 coils/phase with 22 turns/coil the span is 5 slots. If the fundamental component of magnetic flux is 3 mwb, calculate the open circuit phase emf at 3200 rpm.

Solution

No. of poles = 4

No. of stator slots = 24

coils/pole = 3

Turns/coil = 22

Coil span = 5 slots

ϕ_m = 3 mwb

N = 3200 rpm

Open circuit phase emf = ?

$$f = \frac{NP}{120} \Rightarrow N = \frac{120 f}{P}$$

$$f = \frac{4 \times 3200}{120} = 106.66 \text{ Hz}$$

No. of turns / phase = No. of turns / coil × coils / pole / phase × No. of poles.

$$= 22 \times 3 \times 4 = 264$$

emf = 4.44 f ϕ_m K_{w1} T_{ph}

$$K_{w1} = K_{d1} \times K_{p1} \times K_{s1}$$

$$K_{d1} = \frac{\sin \frac{m\beta}{2}}{m \sin \frac{\beta}{2}}$$

where m = slots / pole / phase

$$m = \frac{24}{4 \times 3} = 2$$

β = slot angle = $\frac{180^\circ}{n}$

n = slots / pole

$= \frac{24}{4} = 6$

$\beta = \frac{180}{6} = 30^\circ$

$$k_{d1} = \frac{\sin\left(\frac{2\times 30}{2}\right)}{2\sin\left(\frac{30}{2}\right)} = 0.965$$

$$k_{p1} = \frac{\cos\alpha}{2} = \cos\frac{30}{2} = 0.965$$

$k_{s1} = 1$

$k_{w1} = k_{d1} \times k_{p1} \times k_{s1}$

$= 0.965 \times 0.965 \times 1$

$= 0.9312$ //

$emf = 4.44 \times 106.66 \times 3\times10^{-3} \times$
0.9312×264

$emf = 347.26\ V$ //