Assignment

Q1- A 3-phase induction motor has 26 poles and is connected to 50 Hz AC supply. Find the synchronous speed of the RMF in the motor.

Ans:- The synchronous speed of induction motor can be given as,

$$N_s = \frac{120 \times f}{p}$$

where 'N_s' is the synchronous speed in rpm, 'f' is the frequency in hertz and 'p' is no of poles. Hence, according to given data it will be,

$$N_s = \frac{120 \times 50}{26}$$

$$N_s = 230.77 \text{ rpm}$$

note:- The synchronous speed is directly proportional to frequency and inversely proportional to no. of pole.

Q2:- A 3-phase induction motor is wound for 8 poles and is supplied from 50 Hz source. Calculate :-

(a) Synchronous speed

(b) slip of the motor when speed is 720 RPM.

Ans :- (a) Synchronous speed $= \frac{120 \times f}{p}$

$$= \frac{120 \times 50}{8} = 750 \text{ rpm.}$$

(b) The induction motor rotates at a speed (N_r) close but less than the synchronous speed.

Slip of an induction motor is given by,

$$s = \frac{N_s - N_r}{N_s}$$

where, N_s is the synchronous speed

N_r = rotor speed.

$$\text{Slip} = \frac{750 - 720}{750} = \underline{0.04} \text{ Ans}$$

current frequency $= s \times f = 0.04 \times 50 = 2 \text{ Hz}.$

Q3 :- A 250 V DC series motor runs at 1000 RPM when drawing a line current of 50A. The armature and series field resistances are 0.08 Ω and 0.05 Ω respectively. If the current taken by the motor remains the same, determine the value of series resistance required to reduce the speed to 800 R.P.M.

Ans :- Since magnetization is linear hence magnetising flux is directly proportional to armature current in dc series motor

$\phi \propto I_a$

Torque $T \propto I_a^2$

Back Emf $E = V - I_a(R_a + R_{se})$

where, R_a = armature resistance

R_{se} = series field resistance.

Calculation :-

$V = 250V$

$I_a = 50A$

$R_a = 0.08\,\Omega$

$R_{se} = 0.05\,\Omega$

$\therefore$ $R_a + R_{se} = 0.08 + 0.05 = 0.13\,\Omega$

$E = 250 - 50 \times 0.13 = 243.5$ volt.

Given that the current remains same.

$\therefore I_a =$ constant.

$E \propto N$

E at 1000 RPM = 243.5 volt.

$\therefore$ at 800 RPM = $\dfrac{243.5}{1000} \times 800 = 194.8\,V.$

$\because E = V - I_a \times (R_a + R_{se})$

$\Rightarrow 194.8 = 250 - 50\,(0.08 + R_{se})$

$\Rightarrow 50 \times 0.08 + 50R_{se} = 55.2$

$\Rightarrow 50R_{se} = 55.2 - 4$

$\Rightarrow R_{se} = \dfrac{51.2}{50}$

$\Rightarrow R_{se} = 1.024\ \Omega$ Ans