Briggs Francis Francis soibi

(1)

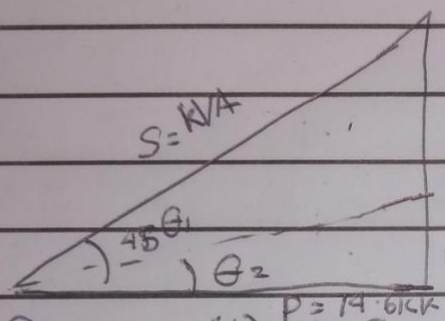
415V

~~415~~ $415/\sqrt{3} = 239.6$

f = 50

P = 74.6kW

pf = Cosθ = 0.7 $\cos^{-1} 0.7 = \theta$ 45.5



$\theta_2 = \cos^{-1}(1) = 0$

(1)

~~Q~~(kVAr) = S(kVA) sinθ

$\Rightarrow \tan\theta_1 = \frac{Q}{P}$ $\tan 45.5 = \frac{Q}{74.6}$

Q = 75.9 kVr

$\tan\theta_2 = \frac{Q_2}{P}$ $\tan(0) \times P = Q_2$

$Q_2 = 0$

$\Delta Q = Q_1 - Q_2 = 75.9$kVr

~~Kvar~~ ~~ΔQ~~ $Q = P(\tan\theta_1 - \tan\theta_2)$

$\Rightarrow Q = 74.6(\tan 45.5 - \tan 0)$

$$\Delta Q = \frac{V^2}{\frac{1}{2\pi f C}}$$

$$\Delta G = C 2\pi f V^2$$

$$C = \frac{\Delta G}{2\pi f V^2} \Rightarrow \frac{75.9}{2 \times \pi \times 50 \times (239.6)^2}$$

$$C = 4.20 \times 10^{-6} \text{ F}$$

I =

ii)

0.9 lagg

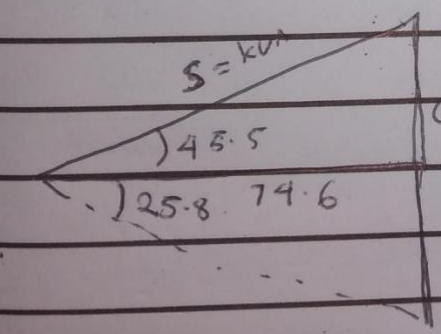
$-\cos(\theta_2) = 0.9$

$\theta_2 = \cos^{-1}(0.9)$

$\theta_2 = -25.8$

$Q_2 = P \tan \theta_2$

$Q_2 = -36.06$ kVAr



ΔQ

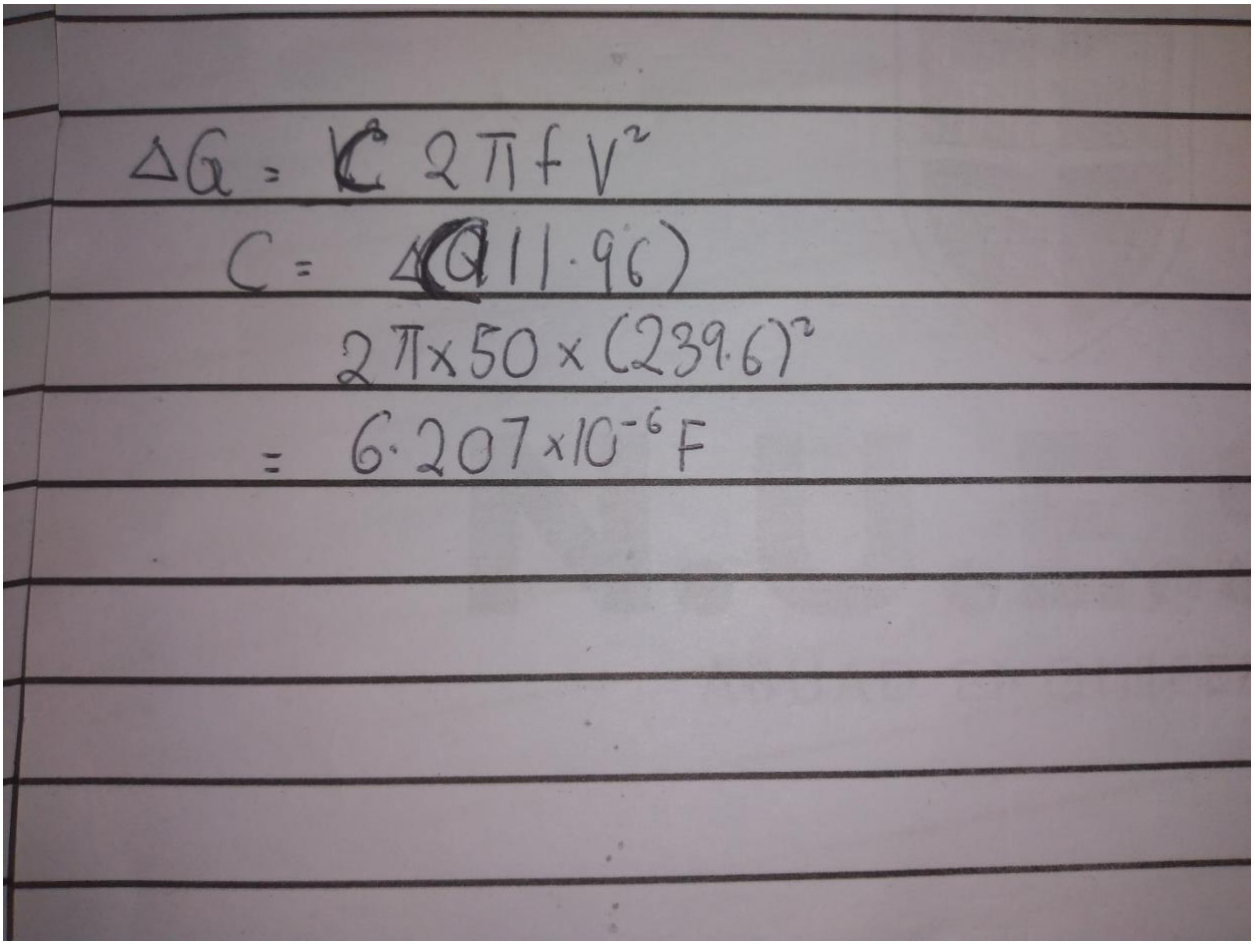
$= 75.9 - -36.06$

$75.9 + 36.06$

$= 111.96$ kVAr.

$C = P(\tan\theta_1 - \tan\theta_2)$

$= 74.6(\tan(45.5) - \tan(-25.8))$


ΔQ = C 2πfV²
C = ΔQ (11.96)
2π×50×(239.6)²
= 6.207×10⁻⁶F

(2)

$V_L = 415\ V$ $\quad V_{phase} = 415/\sqrt{3} = 239.6\ V$

poles = 6

$f = 50\ Hz$

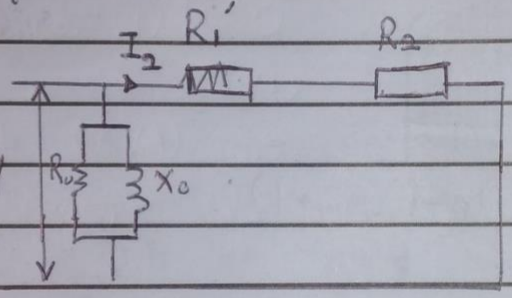
$\frac{stator}{rotor} = \frac{6}{5} = \frac{1}{K} \Rightarrow K = \frac{5}{6} = 0.83$

~~stator im~~ $R_1 = 0.25 + j0.75\ \Omega$

$R_2 = 1.73 + j0.52$

$S = 1$

i)



(i)

R_1' (referred to the rotor) $= R_1 \times K^2$

$R_1' = (0.25 + j0.75) \times (0.83)^2 = 0.172 + 0.516j$

$I_2 = \frac{V_{phase}}{R_1' + R_2} = \frac{239.6}{0.172 + 0.516j + 1.73 + j0.52}$

$I_2 = 97.14 - j52.92$

$I_2 = 110.62 \angle -28.57^\circ\ A$

BRIGGS FRANCIS (3)

3) $f = 50Hz$

$N_{dc} = 2000 rpm$

$I = 0.7A$

$R = 15\Omega$

$I = 0.25\Omega$

$V_{ac} = 220V$

(i)

~~$V_{dc} = E_b - IR$~~

$E_b = V_{dc} - IR$

$E_b = 220 - 0.7(15) = 209.5V$

IR = resistance drop = $10.5V$

for ac

reactance drop = $IX = 0.7 \times 2\pi fL$

$0.75 \times 2 \times 50 \times \pi \times 0.25$

$= 58.904 V$

Counter emf = $E = \sqrt{V^2 - (IX^2)} - IR$

$E = \sqrt{(220)^2 - (58.90)^2} - 10.5$

$E = 201.46$ volts

$N_{ac} = \frac{N_{dc} \times E}{E_b} \Rightarrow \frac{2000}{209.5} \times 201.46$

$= 1923 rpm$ Ans

~~power~~ (ii)

power factor = $\cos\phi = \frac{E + IR}{V} = \frac{201.46 + 10.15}{220}$

pf = 0.96

BRIGGS FRANCIS (4)

$$\text{Torque} = \frac{9.55 \times P}{N_{RC}}$$

$P = f \times l$

$$\Rightarrow \frac{9.55 \times 201.4 \times 0.7}{1923}$$

$$= 0.70 \text{ Nm}$$

(iv) Universal motor