AKUMA SUNNY. U.
17/ENG04/009
ELECT/ELECT
EEE326 : ASSIGNMENT II

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Solutions

$S = 25\,kVA,\ V = 415\,V,\ 3-\phi,\ 4\ pole\ \ f = 60Hz,\ X_2 = 1.5$

$R_2 = 0$

$\cos\theta;\ P.f = 0.8\ lagging$

(a) E_a;

$E_a = V_f + jX_2 I_a + R_2 I_a$

$\equiv V_p + jX_2 I_a$

$\cos\theta = 0.8$

$\therefore\ \theta = 36.87$

$V_L = 415 \rightarrow V_p = \frac{415}{\sqrt{3}}$

$= 239.60$ $\quad 239.6 \angle 0$

$I_a = \frac{S}{\sqrt{3} \times V_L} = \frac{25 \times 10^3}{\sqrt{3} \times 415}$

$= 34.78$

$\underline{\sim}\ 34.78 \angle -36.87$

$E_a = V_p + jX_2 I_a$

$E_a = 239.6 \angle 0 + 1.5 \angle 90^\circ \times 34.78 \angle -36.87$

$= 270.9 + j4174$

$\underline{\sim}\ 274.1 \angle 8.76\ V$

(b) If Increased 20%, find I_A, P.F & Q

i) I_A

$$I_a = \frac{E_a - V}{jX_2}$$

$$\therefore I_A = \frac{E_{a_2} - V_2}{jX_2}$$

$$E_{a_2} = 1.2 \times E_a = 1.2 \times 274.1$$

$$= 328.92$$

$$E_1 \sin\delta_1 = E_2 \sin\delta_2$$

$$\rightarrow \sin\delta_2 = \frac{E_1 \sin\delta_1}{E_2}$$

$$= \frac{274.1 \sin 8.76}{328.92}$$

$$\sin\delta_2 = 0.127$$

$$\delta_2 = 7.47$$

$$\therefore I_A = \frac{328.92 \angle 7.47 - 231.6 \angle 0}{1.5 \angle 90^\circ}$$

$$= 28.51 - j57.69$$

$$I_A \simeq 64.35 \angle -63.7A$$

ii) $P.f = \cos\theta$

$= \cos(-63.7)$

$= 0.4$ lagging

iii) $Q = \sqrt{3} \times V_L \times I_L \times \sin\theta$

$\sqrt{3} \times 415 \times 64.35 \times \sin 63.7$

$= 41466.85$

$\simeq 41.5$ KVAR

(c) $I_{A_3} = \dfrac{E_{a3} - V}{jX_2}$

Since its using the same condition as in (a)

$= \dfrac{274.1 \angle 90^\circ - 239.6 \angle 0}{1.5 \angle 90}$

$= 164.73 + j159.73$

$I_{A_3} \approx 229.46 \angle 44.12$

ii) $P.f = \cos\theta$

$= \cos(44.12)$

$= 0.7$ leading

iii) $\sqrt{3} \times V_L \times I_L \times \sin\theta$

$\sqrt{3} \times 415 \times 229.46 \times \sin 44.12$

$= 114822.48$

$\simeq 11.5$ KVAR