

Notanra mADUACUWA

$$S_r = 25 \text{ kVA}, V_r = 415 \text{ V}, 3-\phi, 4\text{-pole}, F = 60 \text{ Hz}, X_2 = 1.5, R_2 = 0, \cos \theta = 0.8$$

a) E_a ,

$$E_a = V_p + jX_2 I_a + R_2 I_a$$

$$= V_p + jX_2 I_a$$

$$\ast \cos \theta = 0.8$$

$$\theta = 36.87$$

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

$$\sqrt{3}$$

$$= 239.6 \text{ V}$$

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

$$= 34.78$$

$$\underline{\underline{34.78}} < -36.87$$

$$E_a = V_p + jX_2 I_a$$

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

$$= 270.9 + j41.74$$

$$= 274.1 \angle 8.76^\circ \text{ V}$$

b) when increased by 20%

$$I_a = \frac{E_{a2} - V_r}{jX_2}$$

$$E_{a2} = 1.2 \times E_a = 1.2 \times 274.1$$

$$= 328.92$$

to find S_r

$$E_1 S_m \delta = E_2 S_m \delta$$

$$274.1 \sin 8.76 = 328.92 \sin 32$$

$$\sin 32 = \frac{274.1 \sin 8.76}{328.92}$$

$$\sin 32 = 0.127$$

$$32 = 7.47$$

$$\text{thus } I_a = 328.92 \angle 7.47 - 239.6 \angle 0$$

$$1.5 \angle 90^\circ$$

$$= 28.51 - j 57.69$$

$$I_a = 64.33 \angle -63.7^\circ \text{ A}$$

$$\begin{aligned} \text{ii) } P.F. &= \cos \theta \\ &= \cos(-63.7^\circ) \\ &= 0.4 \text{ lagging} \end{aligned}$$

$$\begin{aligned} \text{iii) } Q &= \sqrt{3} \times V_L \times I_L \times \sin \theta \\ &= \sqrt{3} \times 915 \times 64.33 \times \sin 63.7^\circ \\ &= 41466.85 \\ &= 41.5 \text{ kVAR} \end{aligned}$$

$$\text{c) } I_{a3} = \frac{Z_{A3} \cdot V_{L3}}{jX_2}$$

Conductors remain the same as a thus V & I the same

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

$$= 167.73 + j 159.73$$

$$I_{a3} = 229.46 \angle 44.12^\circ$$

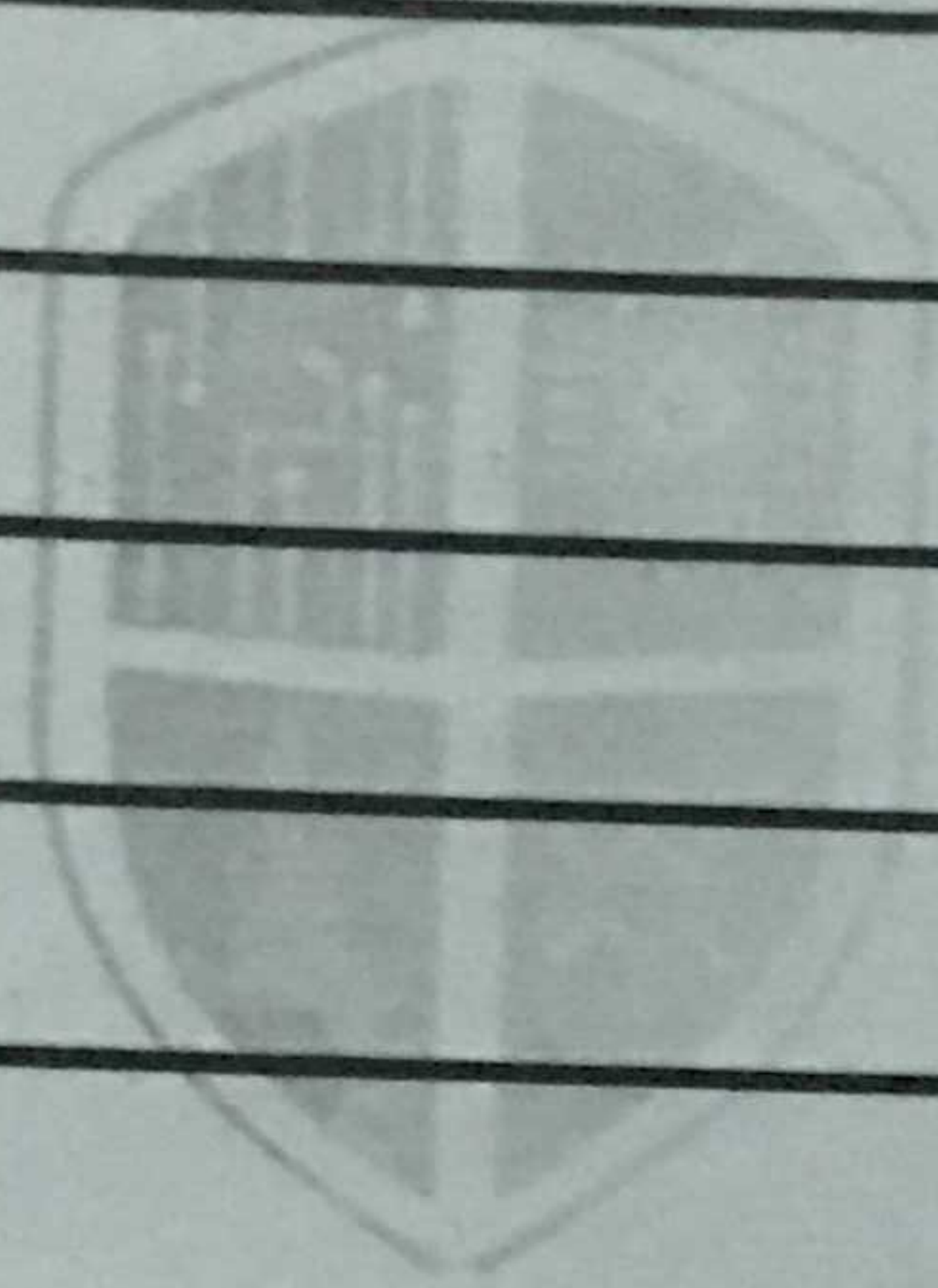
$$\begin{aligned} \text{ii) } P.F. &= \cos \theta \\ &= \cos(44.12^\circ) \\ &= 0.7 \text{ leading} \end{aligned}$$

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

$$= \sqrt{3} \times 415 \times 229.46 \times \sin 44.12^\circ$$

$$= 114822.748$$

$$\approx 11.5 \text{ MW}$$



N.U.E.S.A

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