Circuits2

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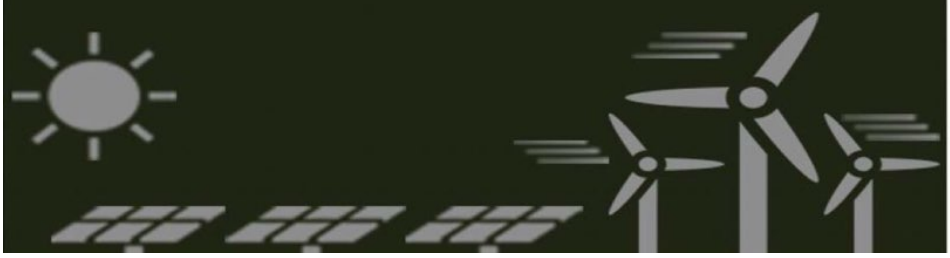


PU 2018

PF correction:-

→ inductive load ⟶ add capacitor.

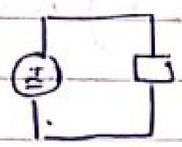
→ capacitive load ⟶ add inductor. ([illegible])

Ex.

a 50 KW Induction motor is working at 0.8 lagging PF & is supplied by 230 ~~watt~~ Vrms

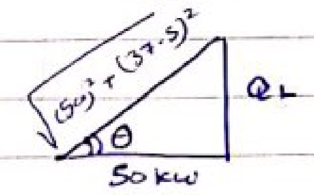
It is required to make the pF = 0.95 lagging

→ Find the value of capacitor that be added to make such a correction.



50 kw
0.8 lagging

* Befor adding the capacitor.



$\cos^{-1}(0.8) = \theta$, $\cos\theta = pF$.

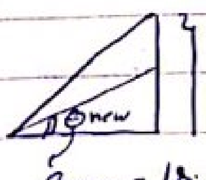
$\theta = 36.81°$

$\tan(36.81°) = \dfrac{Q_L}{50 \times 10^3}$

$Q_L = 37.5$ K VAR.

⟹ $PF = 0.95$

$\theta_{new} = \cos^{-1}(0.95) = 18.19°$



$\theta_{new} = 18.19°$

$\tan(18.19°) = \dfrac{Q_L - Q_c}{50 \times 10^3}$ ⟶ $Q_L - Q_c = 16.43$ (Q_L: Qold)

$Q_{new} = Q_{old} - Q_c = 16.43$ K VAR.

$Q_c = (16.43 - 37.5)$, $|Q_c| = 21.06$ KVAR.

-ve [illegible]

$Q_c = V_{rms} I_{rms} \sin(\theta - \phi)$

current leads voltage by $\pi/2$

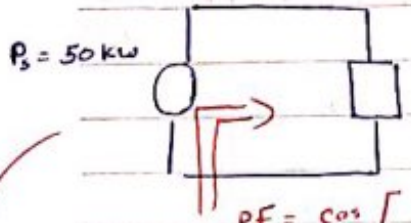
$\sin(\theta - \phi) = 1$

$Q_c = |V_{rms}||I_{rms}|$

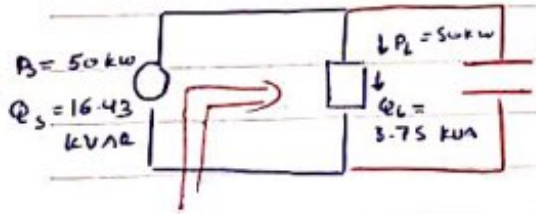
$Q_c = |V_{rms}|\frac{|V_{rms}|}{X_c}$ ← $1/\omega C$

$Q_c = V_{rms}^2 * \omega * C$

$C = \frac{Q_c}{V_{rms}^2 * \omega} = \frac{21,060}{(230)^2 * 2 * \pi * 50}$ ($2\pi f$) ← 50 Hz



$PF = \cos\left[\tan^{-1}\left(\frac{3.75}{50}\right)\right]$ lagging $= 0.8$



$PF = \cos\left(\tan^{-1}\left(\frac{16.43}{50}\right)\right) = 0.95$

$S = VI^*$

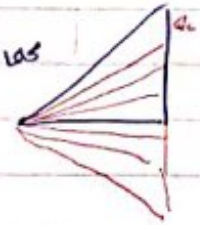
$I = \left(\frac{S}{V}\right)^* = \frac{50 * 10^3 - j16.43 * 10^3}{230 \angle 0}$

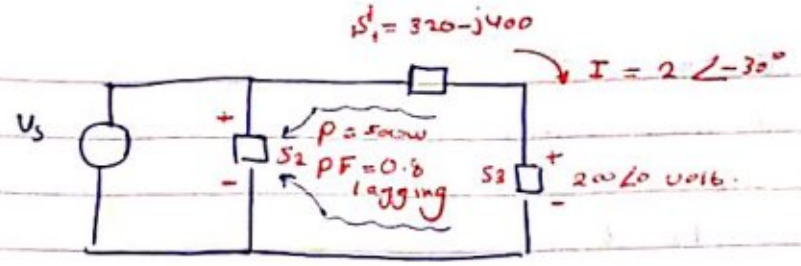
$= 228.8 \angle 18.19$

$S = VI^*$

$I = \frac{S^*}{V^*} = \frac{50 * 10^3 - j37.5 * 10^3}{230} = 271.7 \angle -36.87$

كما زادت C قل حجم المكثف.





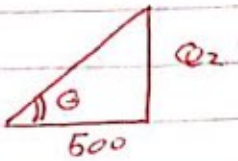
Ex. find the source voltage & its pF.

S' (source) $= S_1' + S_2' + S_3'$

$S_1 = 320 - j400$

$S_2' = 500 + jQ_2$ ⟶

$S_3 = U_3 I_3^* = 400 \angle 30$



$\cos^{-1}(0.8) = \theta$

$\theta = 36.87°$

$S_3' = \frac{400\sqrt{3}}{2} + j200$

$\tan^{-1}(36.87°) = \frac{Q_2}{500}$

$Q_2 = VV$

$U_s = U_1 + U_3$

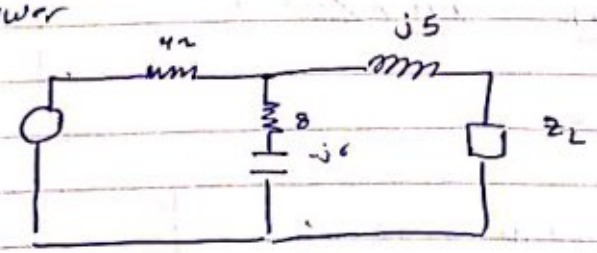
$U_3 = 200 \angle 0$

$U_1 = \frac{S}{I^*}$

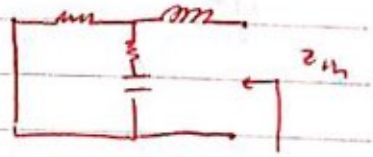
$U_1 = \frac{320 - j400}{2 \angle 30}$ volt.

Ex.

Determine the load impedance "Z_L" that maximize average power drawn from the CKT & what is this maximum power



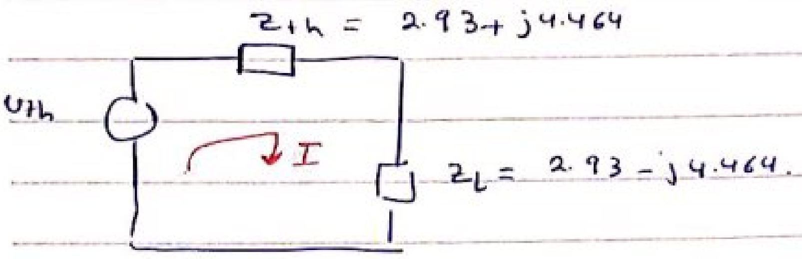
kill ⟶ voltage source.



$Z_{th} = j5 + 4 \parallel (8 - j6)$

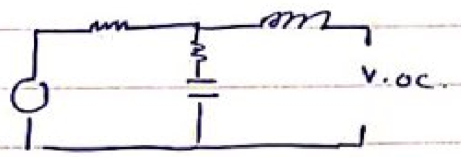
$Z_{th} = 2.933 + j4.467$

$Z_L = Z_{th}^* = 2.933 - j4.467.$



$I = \frac{V_{th}}{2 + 2.93}$

$V_{th} = V.o.c.$



$V_{th} = V_{oc} = 10\angle 0 * \frac{8 - j6}{12 - j6} = 7.45 \angle -10.3^\circ$

* بدون ما يحدد نوع ال power
أكيد بده اياها بالسؤال
* بعتبره بده ال
(Real power.)

$I_{rms} = \frac{V_{th}}{2 + R_L}$

$P_L = 2.93 * I_{rms}^2$

$I = \frac{7.45 \angle -16.3}{2 + 2.93} = 1.27 \angle -10.3$

$P_L = 2.93 (1.27)^2 \cdot$ watt.