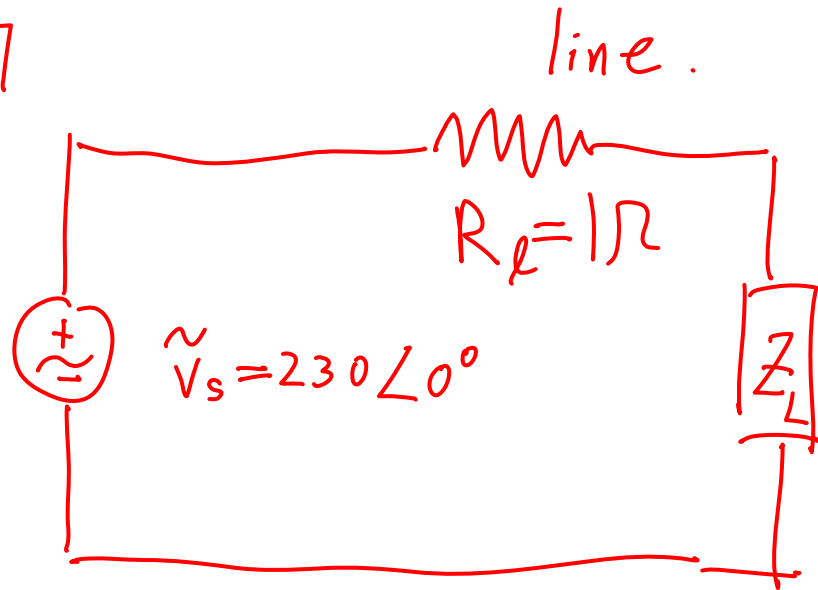


7.17



$$Z_L = (10 + 3j) \Omega$$

$$(1) P_{avL} = ?$$

$$(2) P_{avR} = ?$$

$$(3) |S_s| = ?$$

$$(4) pf_L = ?$$

$$(5) pf_s = ?$$

$$(1) \tilde{I}_s = \frac{\tilde{V}_s}{Z_L + R_\ell} = \frac{(230 \angle 0^\circ) V}{(11 + 3j) \Omega}$$

$$= \frac{230 \angle 0^\circ}{11.4 \angle 15.2^\circ} = 20.18 \angle -15.2^\circ \text{ (A)}$$

$$P_{avL} = |\tilde{I}_s|^2 \cdot R_L = (20.18)^2 \times 10 = 4072 \text{ W}$$

$$P_{avL} = |S_L| \cos \theta_L$$

$$\tilde{V}_L = \tilde{I}_s \cdot Z_L = (20.18 \angle -15.2^\circ)(10 + 3j)$$

$$\begin{aligned}\tilde{V}_L &= (20.18 \angle -15.2^\circ) (10.4 \angle 16.7^\circ) \\ &= 210 \angle 1.5^\circ \quad (\text{V})\end{aligned}$$

$$\begin{aligned}S_L &= \tilde{V}_L \cdot \tilde{I}_s^* = (210 \angle 1.5^\circ) (20.18 \angle 15.2^\circ) \\ &= 4238 \angle 16.7^\circ\end{aligned}$$

$$P_{\text{av}L} = |S_L| \cos \theta_L = 4238 \cos 16.7^\circ = 4059 \text{ (W)}$$

$$(2) P_{\text{av}R} = |\tilde{I}_s|^2 \cdot R = 407 \text{ W}$$

$$\begin{aligned}(3) |S_s| = ? \quad S_s &= \tilde{V}_s \cdot \tilde{I}_s^* \\ &= (230 \angle 0^\circ) (20.18 \angle +15.2^\circ) \\ &= 4641 \angle 15.2^\circ\end{aligned}$$

$$\begin{aligned}|S_s| &= 4641 \text{ VA} && \approx P_{\text{av}L} + P_{\text{av}R} \\ \text{check } |S_s| \cos 15.2^\circ &= 4478\end{aligned}$$

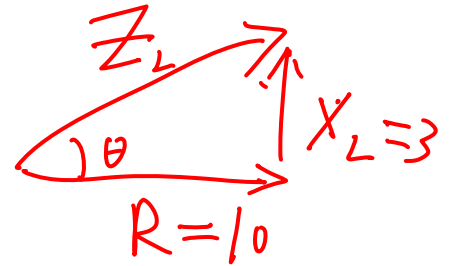
$$(4) \text{ pf}_L = ? \quad S_L = 4238 \angle 16.7^\circ$$

$$\text{pf}_L = \cos 16.7^\circ = 0.9578$$

method 2: $Z_L = (10 + 3j) \Omega$

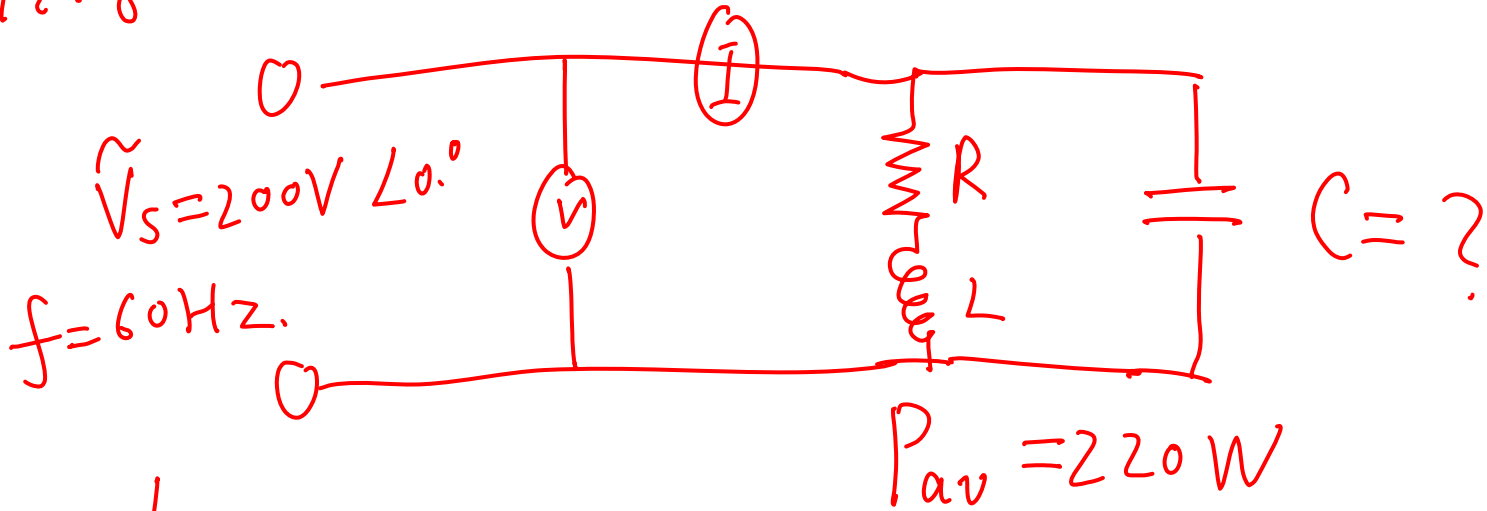
$$\theta = \tan^{-1}\left(\frac{3}{10}\right)$$

$$\cos \theta = \text{pf}_L$$



$$(5) \text{ pf}_S = \cos(15.2^\circ) = 0.965$$

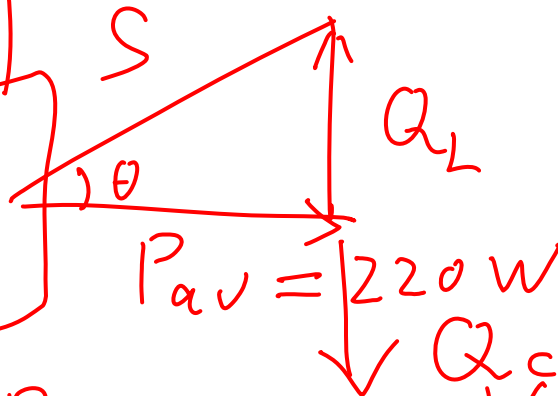
7.18



lagging $p_f = 0.8 = \cos \theta$ $\theta = 36.87^\circ$

$$|Q_c| = |Q_L| = 165 \text{ (VAR)}$$

$$|Q_c| = \frac{|\tilde{V}_s|^2}{|Z_c|} = \omega C |\tilde{V}_s|^2$$



$$C = \frac{|Q_c|}{|\tilde{V}_s|^2 \omega} = \frac{165}{(200)^2 2\pi(60)}$$

$$= 1.1 \times 10^{-5} \text{ (F)}$$

$$Q_L = P_{av} \tan \theta = 165 \text{ (VAR)}$$

11
11 μF