Three Phase Circuits

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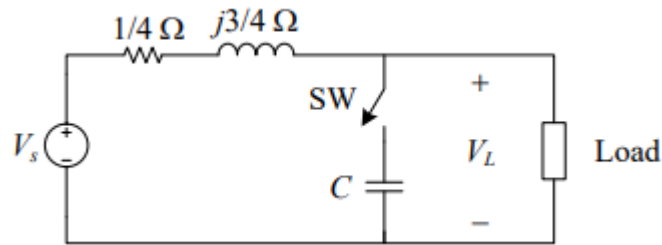
Examples

Homework 4

1)

Figure 1: Question

$V_L 6\sqrt{5}$ and $pf = \frac{1}{\sqrt{5}}$ obtainin phasor diagram. Related phasor diagram is;
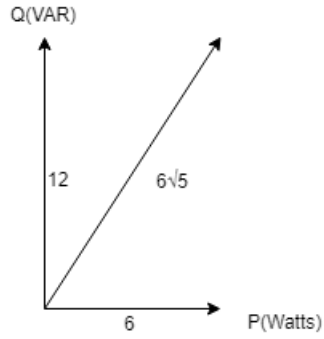
Figure 2: Phasor diagram of load

Since total reactive power 24 VAR and load reactive power 12 VAR; reactive power on $j\frac{3}{4}$ is 12 VAR.

$$12 = I_A^2 X_{j0.75}$$

$$I_A = 4A$$

$$P_{\frac{1}{4}\Omega} = 4W$$

$$S_{total} = 26VA = V_{RMS}I_{RMS}$$

$$V_{S_{RMS}} = 6.5V$$

$$S_L = 6\sqrt{5}VA = V_{RMS}I_{RMS}$$

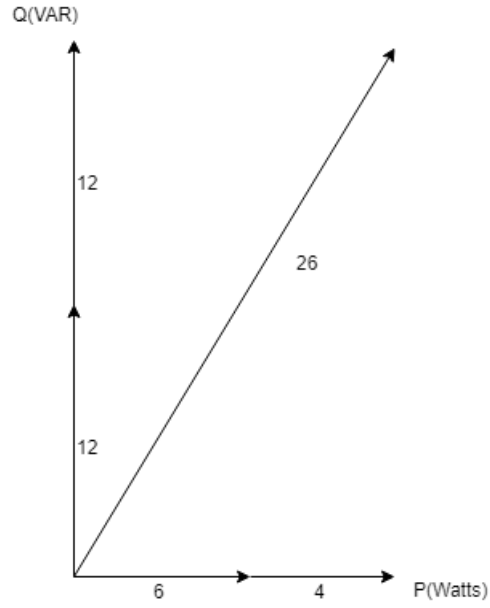$$V_{S_{RMS}} = \frac{3\sqrt{5}}{2}$$

Figure 3: Overall phasor diagram

Then switch closed, since load voltage kept same load has same phasor diagram.

$$P = 7W$$

1W comes from line resistor meaning that $I_A = 4\,A$ then $Q_{j\frac{3}{4}} = 3\,VAR$. There are infinite solution for each capacitor values. however for the sake of calculation i set $Q_c = 15\,VAR$
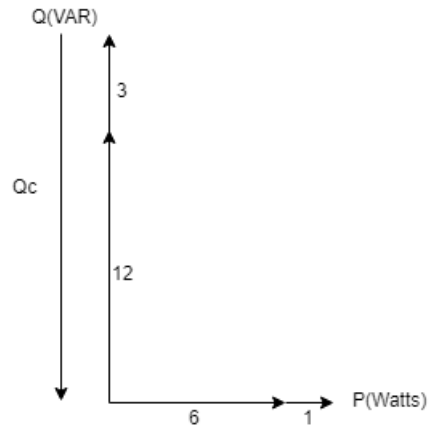
Figure 4: Updated phasor diagram

$$Q_c = -15 = \frac{45}{4X_c}$$

$$X_c = -j\frac{3}{4}$$

$$B_c = \frac{4}{3}S$$