Chapter 11, Solution 93

(a) $P_1 = (5)(0.7457) = 3.7285$ kW

$$S_1 = \frac{P_1}{pf} = \frac{3.7285}{0.8} = 4.661 \text{ kVA}$$

$Q_1 = S_1 \sin(\cos^{-1}(0.8)) = 2.796$ kVAR

$\mathbf{S}_1 = 3.7285 + j2.796$ kVA

$P_2 = 1.2$ kW, $Q_2 = 0$ VAR

$\mathbf{S}_2 = 1.2 + j0$ kVA

$P_3 = (10)(120) = 1.2$ kW, $Q_3 = 0$ VAR

$\mathbf{S}_3 = 1.2 + j0$ kVA

$Q_4 = 1.6$ kVAR, $\cos\theta_4 = 0.6 \longrightarrow \sin\theta_4 = 0.8$

$$S_4 = \frac{Q_4}{\sin\theta_4} = 2 \text{ kVA}$$

$P_4 = S_4 \cos\theta_4 = (2)(0.6) = 1.2$ kW

$\mathbf{S}_4 = 1.2 - j1.6$ kVA

$\mathbf{S} = \mathbf{S}_1 + \mathbf{S}_2 + \mathbf{S}_3 + \mathbf{S}_4$

$\mathbf{S} = 7.3285 + j1.196$ kVA

Total real power = **7.3285 kW**

Total reactive power = **1.196 kVAR**

(b) $$\theta = \tan^{-1}\left(\frac{1.196}{7.3285}\right) = 9.27°$$

$pf = \cos\theta =$ **0.987**