

### Chapter 11, Solution 71.

(a) For load 1,

$$Q_1 = 60 \text{ kVAR, pf} = 0.85 \text{ or } \theta_1 = 31.79^\circ$$

$$Q_1 = S_1 \sin \theta_1 = 60 \text{ k or } S_1 = 113.89 \text{ k and } P_1 = 113.89 \cos(31.79) = 96.8 \text{ kW}$$

$$S_1 = 96.8 + j60 \text{ kVA}$$

$$\text{For load 2, } S_2 = 90 - j50 \text{ kVA}$$

$$\text{For load 3, } S_3 = 100 \text{ kVA}$$

Hence,

$$S = S_1 + S_2 + S_3 = 286.8 + j10 \text{ kVA} = 287 \angle 2^\circ \text{ kVA}$$

$$\text{But } S = (V_{\text{rms}})^2 / Z^* \text{ or } Z^* = 120^2 / 287 \angle 2^\circ \text{ k} = 0.05017 \angle -2^\circ$$

$$\text{Thus, } Z = 0.05017 \angle 2^\circ \Omega \text{ or } [50.14 + j1.7509] \text{ m}\Omega.$$

$$\text{(b) From above, pf} = \cos 2^\circ = 0.9994.$$

$$\text{(c) } I_{\text{rms}} = V_{\text{rms}} / Z = 120 / 0.05017 \angle 2^\circ = 2.392 \angle -2^\circ \text{ kA or } [2.391 - j0.08348] \text{ kA.}$$