Chapter 11, Solution 51.

For the entire circuit in Fig. 11.70, calculate:

(a) the power factor
(b) the average power delivered by the source
(c) the reactive power
(d) the apparent power
(e) the complex power

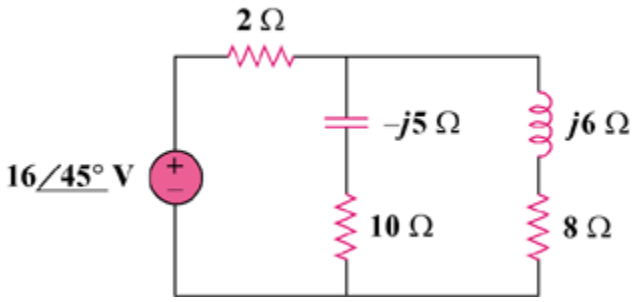

Figure 11.70
For Prob. 11.51.

Solution

(a) $\mathbf{Z}_T = 2 + (10 - j5) \parallel (8 + j6)$

$$\mathbf{Z}_T = 2 + \frac{(10 - j5)(8 + j6)}{18 + j} = 2 + \frac{110 + j20}{18 + j}$$

$$\mathbf{Z}_T = 8.152 + j0.768 = 8.188\angle 5.382^\circ$$

$$\text{pf} = \cos(5.382^\circ) = \mathbf{0.9956} \quad \textbf{(lagging)}$$

(b) $$\mathbf{S} = \mathbf{V}\mathbf{I}^* = \frac{|\mathbf{V}|^2}{\mathbf{Z}^*} = \frac{(16)^2}{(8.188\angle -5.382^\circ)}$$

$$\mathbf{S} = 31.26\angle 5.382^\circ$$

$$P = S\cos\theta = \mathbf{31.12\ W}$$

(c) $$Q = S\sin\theta = \mathbf{2.932\ VAR}$$

(d) $$S = |\mathbf{S}| = \mathbf{31.26\ VA}$$

(e) $\mathbf{S} = 31.26\angle 5.382° =$ **(31.12+j2.932) VA**

(a) 0.9956 (lagging, (b) 31.12 W, (c) 2.932 VAR, (d) 31.26 VA, (e) [31.12+j2.932] VA