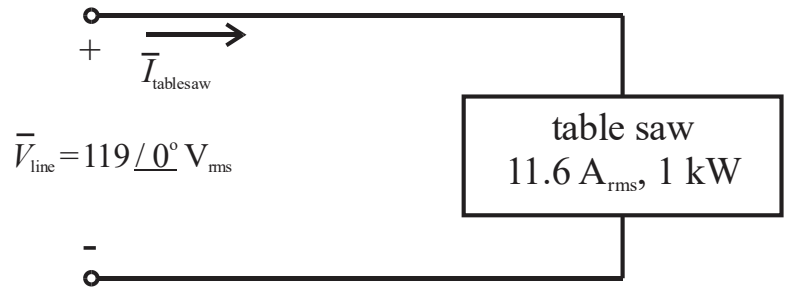


EE 330 Energy Systems (Fall 2026) Quiz #2

Name KEY A

Instructions: Open book & notes. Place answers in indicated spaces and show all work for credit.

A DeWalt table saw is connected to a 60 Hz, 119 V_{rms} single-phase outlet. While cutting 5/4 QSWO, it draws a current of 11.6 A_{rms} and consumes 1 kW of power. Determine the complex power consumed, phasor current (rms) drawn by, impedance, and power factor of the table saw.



Assume the line voltage is at 0°.

Per (1-53), the apparent power is $S = VI = 119(11.6) \Rightarrow S_{\text{tablesaw}} = 1380.4 \text{ VA}$.

Per (1-62) & Fig. 1-23, the power factor is $\text{PF} = \cos(\theta) = P / S = 1000 / 1380.4$

$\Rightarrow \text{PF}_{\text{tablesaw}} = \mathbf{0.7244 \text{ lagging}}$ (lagging since a table saw is a motor driven saw).

From the power factor, we get

$$\theta = \cos^{-1}(\text{PF}) = \cos^{-1}(0.7244) \Rightarrow \theta = \theta_S = \theta_Z = \theta_V - \theta_I = 43.57874^\circ \Rightarrow \theta_I = -43.57874^\circ.$$

Putting magnitudes and phase angles together yields the complex power and phasor current-

$$\Rightarrow \underline{\bar{S}_{\text{tablesaw}} = S_{\text{tablesaw}} \angle \theta_S = 1380.4 \angle 43.57874^\circ (\text{VA}) = 1000 + j951.58 (\text{VA})}$$

and $\Rightarrow \underline{\bar{I}_{\text{tablesaw}} = I_{\text{tablesaw}} \angle \theta_I = 11.6 \angle -43.57874^\circ \text{ A}_{\text{rms}}}$.

By Ohms' Law, the impedance is $\underline{\bar{Z}_{\text{tablesaw}} = \bar{V} / \bar{I}_{\text{tablesaw}} = 119 \angle 0^\circ / 11.6 \angle -43.57874^\circ}$

$$\Rightarrow \underline{\bar{Z}_{\text{tablesaw}} = 10.2586 \angle 43.57874^\circ \Omega = 7.43 + j7.07 \Omega}.$$

$$\bar{S}_{\text{tablesaw}} = \underline{\mathbf{1380.4 \angle 43.58^\circ \text{ VA} = 1000 + j951.58 \text{ VA}}}$$

$$\bar{I}_{\text{tablesaw}} = \underline{\mathbf{11.6 \angle -43.58^\circ \text{ A}_{\text{rms}}}}$$

$$\bar{Z}_{\text{tablesaw}} = \underline{\mathbf{10.26 \angle 43.58^\circ \Omega = 7.43 + j7.07 \Omega}}$$

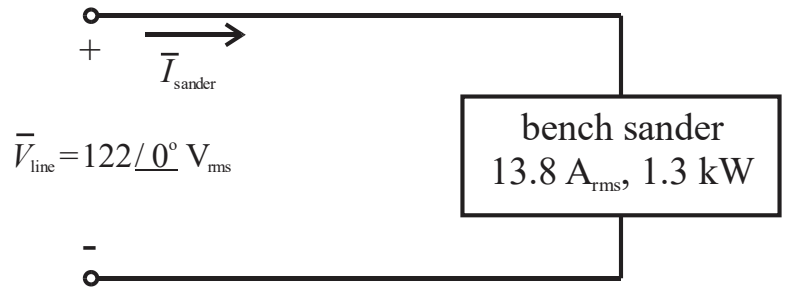
$$\text{PF}_{\text{tablesaw}} = \underline{\mathbf{0.724 \text{ lagging}}}$$

EE 330 Energy Systems (Fall 2026) Quiz #2

Name KEY B

Instructions: Open book & notes. Place answers in indicated spaces and show all work for credit.

A Jet bench sander is connected to a 60 Hz, 122 V_{rms} single-phase outlet. While sanding 8" x 5/4 QSWO, it draws a current of 13.8 A_{rms} and consumes 1.3 kW of power. Determine the complex power consumed, phasor current (rms) drawn by, impedance, and power factor of the sander.



Assume the line voltage is at 0°.

Per (1-53), the apparent power is $S = VI = 122(13.8) \Rightarrow S_{\text{sander}} = 1683.6 \text{ VA}$.

Per (1-62) & Fig. 1-23, the power factor is $\text{PF} = \cos(\theta) = P / S = 1300 / 1683.6$

$\Rightarrow \text{PF}_{\text{sander}} = \underline{\underline{0.772155 \text{ lagging}}}$ (lagging since a bench sander is motor driven).

From the power factor, we get

$$\theta = \cos^{-1}(\text{PF}) = \cos^{-1}(0.772155) \Rightarrow \theta = \theta_S = \theta_Z = \theta_V - \theta_I = 39.4522^\circ \Rightarrow \theta_I = -39.4522^\circ.$$

Putting magnitudes and phase angles together yields the complex power and phasor current-

$$\Rightarrow \underline{\underline{\bar{S}_{\text{tablesaw}} = S_{\text{tablesaw}} \angle \theta_S = 1683.6 \angle 39.4522^\circ (\text{VA}) = 1300 + j1069.82 (\text{VA})}}$$

and

$$\Rightarrow \underline{\underline{\bar{I}_{\text{tablesaw}} = I_{\text{tablesaw}} \angle \theta_I = 13.8 \angle -39.4522^\circ \text{ A}_{\text{rms}}.}}$$

By Ohms' Law, the impedance is $\underline{\underline{\bar{Z}_{\text{tablesaw}} = \bar{V} / \bar{I}_{\text{tablesaw}} = 122 \angle 0^\circ / 13.8 \angle -39.4522^\circ}}$

$$\Rightarrow \underline{\underline{\bar{Z}_{\text{tablesaw}} = 8.84058 \angle 39.4522^\circ \Omega = 6.826 + j5.618 \Omega.}}$$

$$\bar{S}_{\text{sander}} = \underline{\underline{1683.6 \angle 39.45^\circ \text{ VA} = 1300 + j1069.82 \text{ VA}}}$$

$$\bar{I}_{\text{sander}} = \underline{\underline{13.8 \angle -39.45^\circ \text{ A}_{\text{rms}}}}$$

$$\bar{Z}_{\text{sander}} = \underline{\underline{8.84 \angle 39.45^\circ \Omega = 6.83 + j5.62 \Omega}}$$

$$\text{PF}_{\text{sander}} = \underline{\underline{0.772 \text{ lagging}}}$$