

**[5.1]**

Convert the  $\Delta$ -connected source to a Y-connected source.

$$V_{an} = \frac{V_{ph}}{\sqrt{3}} \angle -30^\circ = \frac{440}{\sqrt{3}} \angle -30^\circ = 254 \angle -30^\circ$$

Convert the  $\Delta$ -connected load to a Y-connected load.

$$Z = Z_Y \parallel \frac{Z_\Delta}{3} = (4 + j6) \parallel (4 - j5) = \frac{(4 + j6)(4 - j5)}{8 + j}$$

$$Z = 5.723 - j0.2153$$

$$I_a = \frac{V_{an}}{Z_L + Z} = \frac{254 \angle -30^\circ}{7.723 - j0.2153} = 32.88 \angle -28.4^\circ \text{ A}$$

$$I_b = I_a \angle -120^\circ = 32.88 \angle -148.4^\circ \text{ A}$$

$$I_c = I_a \angle 120^\circ = 32.88 \angle 91.6^\circ \text{ A}$$

**[5.2]**

Transform the delta-connected load to its wye equivalent:

$$Z_Y = \frac{Z_\Delta}{3} = 7 + j8$$

Using the per-phase equivalent circuit above:

$$I_a = \frac{100 \angle 0^\circ}{(1 + j0.5) + (7 + j8)} = 8.567 \angle -46.75^\circ$$

For a wye-connected load:

$$I_p = I_a = 8.567$$

The apparent power is:

$$S = 3I_p^2 Z_p = 3(8.567)^2 (7 + j8)$$

The average power (real part of  $S$ ) is:

$$P = \text{Re}(S) = 3(8.567)^2 (7) = 1.541 \text{ kW}$$

**[5.3]**

$$Z_Y = 4 + 4j$$

$$Z = 5 + 6j$$

$$I_a = \frac{100 \angle 0^\circ}{5 + 6j} = 12.80 \angle -50.19^\circ \text{ A}$$

$$I_b = 12.80 \angle -170.19^\circ \text{ A}$$

$$I_c = 12.80 \angle 69.81^\circ \text{ A}$$