Example- For an AC motor, we measure the line voltage to be $120 \text{ V}_{\text{RMS}}$ and the line current to be $12 \text{ A}_{\text{RMS}}$ using a multimeter while the power is measured to be $1150 \text{ W}$ using a wattmeter. Determine the apparent power, power factor, complex power, reactive power, and load impedance. [Hint: Motors are resistive-inductive loads.]

\[
\text{Apparent Power } S = V_{\text{rms}} I_{\text{rms}} = 120(12) \\
S = 1440 \text{ VA}
\]

\[
\text{Power Factor } \rho_f = \frac{P}{S} = \frac{1150}{1440} = 0.7986 \text{ lagging}
\]

\[
\Theta_v - \Theta_x = \Theta_2 = \Theta_5 = \cos^{-1}(\rho_f) = \cos^{-1}(0.7986) \\
\Theta_2 = \Theta_5 = +37.002^\circ
\]

\[
\text{Complex Power } \bar{S} = S(\Theta_5) = 1440 \angle 37.002^\circ \text{ VA} \\
\bar{S} = 1150 + j 866.66 \text{ VA}
\]

\[
\text{Reactive Power } Q = \text{Im}(\bar{S}) = 866.66 \text{ VAR}
\]

\[
Z_L = \frac{V}{I} = \frac{120}{12} = 10 \Omega \text{ - Magnitude of impedance} \\
\overline{Z_L} = Z_L \Theta_x = 10 \angle 37.002^\circ \Omega = 7.986 + j 6.018 \Omega
\]