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

Time-average Real Power (given): $\Rightarrow$ **$P = 1150$ W**

Apparent Power: $S = VI = 120\,(12)$ $\Rightarrow$ **$S = 1440$ VA**

Power Factor: $PF = P/S = 1150/1440$ $\Rightarrow$ **$PF = 0.7986$ lagging (*RL* load)**

Complex Power:

$\theta_Z = \theta_S = \cos^{-1}(PF) = \cos^{-1}(0.7986)$ $\Rightarrow$ **$\theta_S = +37.002°$ (*RL* load)**

$\overline{S} = S\angle\theta_S$ $\Rightarrow$ $\overline{S} = 1440\angle 37.002°$ VA $\Rightarrow$ **$\overline{S} = 1150 + j\,866.66$ VA**

Reactive Power: $Q = \mathrm{Im}(\overline{S}) = \mathrm{Im}(1150 + j866.66)$ $\Rightarrow$ **$Q = 866.66$ var**

Load Impedance:

$Z = V/I = 120/12 = 10\ \Omega$

$\theta_Z = \theta_S = \cos^{-1}(PF) = \cos^{-1}(0.7986) = +37.002°$ (*RL* load)

$\overline{Z} = Z\angle\theta_Z$ $\Rightarrow$ $\overline{Z} = 10\angle 37.002°\ \Omega$ $\Rightarrow$ **$\overline{Z} = 7.986 + j\,6.018\ \Omega$**