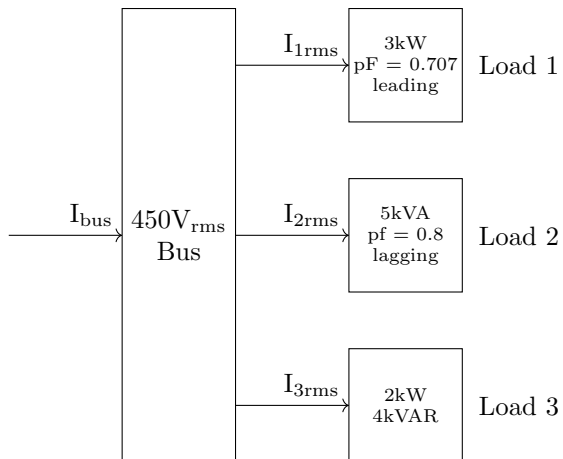1. Analyze the following AC power system with three loads connected to a $450V_{rms}$ bus.

(a) Find the real and reactive powers for each of the 3 loads.

$P_1 =$

$Q_1 =$

$S_1 =$

$P_2 =$

$Q_2 =$

$S_2 =$

$P_3 =$

$Q_3 =$

$S_3 =$

(b) Find the total real and reactive powers supplied by the bus to the loads

$$P_{\text{bus}} = \boxed{}$$

$$Q_{\text{bus}} = \boxed{}$$

(c) Find the bus apparent power.

$$S_{\text{bus}} = \boxed{}$$

(d) Find the RMS value of the bus current.

$$I_{\text{bus}} = \boxed{}$$

2. A 3HP induction motor is powered from a $220V_{rms}$ bus. While delivering rated power, it operates at 80% efficiency and 0.85 power factor (lagging).

(a) Find the real mechanical power out in Watts.

$$P_{mech} = \boxed{}$$

(b) Find the real electrical power into the motor.

$$P = \boxed{}$$

(c) Find the apparent power of the motor

$$S_{motor} = \boxed{}$$

(d) Find the reactive power of the motor.

$$Q_{motor} = \boxed{}$$

(e) Find the current drawn by the motor from the $220V_{rms}$ bus

$$I_{motor} = \boxed{}$$

(f) We wish to reduce this current to 13A by attaching a second item to the $220\mathrm{V_{rms}}$ bus that has only a negative reactive power. Determine the amount of that reactive power.

$$Q_{\text{device}} = \boxed{}$$