

# ECE 470 POWER SYSTEMS I

## Lab # 1 Re-Introduction to Power Lab Equipment

The objective of this lab is to become acquainted with some of the basic measurement techniques and equipment in the power lab.

### PRE-LAB

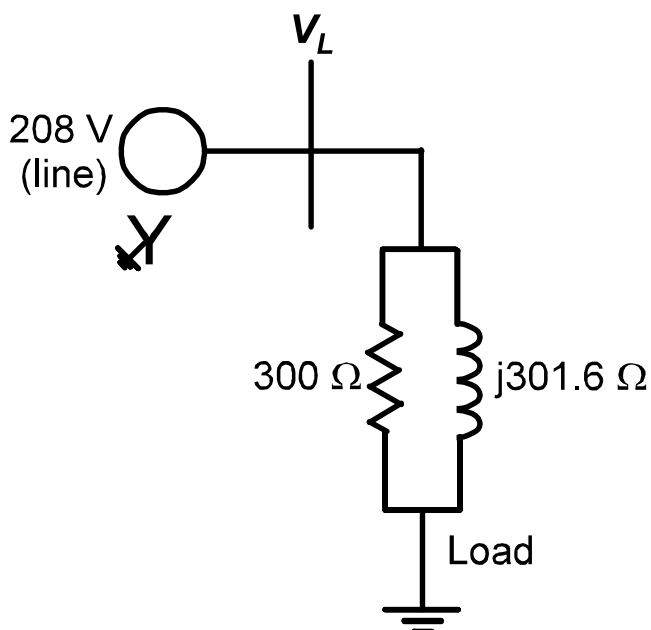
#### Complete this before starting the lab

Calculate the following quantities when a three-phase Y-connected load of  $300 \Omega$  in parallel with  $0.8 \text{ H}$  is supplied from a  $208 \text{ V}$  (line)  $60 \text{ Hz}$  supply:

- Phase-neutral voltages.
- Line currents.
- Real, reactive, and apparent power.
- Power factor and phase angle.

Recall that the inductors draw a few watts each, so you should add about  $6 \text{ W}$  to the predicted real power.

For the one-line diagram shown below, devise circuit diagrams that will measure the above quantities. Use the Yokagawa power meter and oscilloscope for this.



### LAB PROCEDURE

#### Get your circuit approved before starting

Connect the variable  $3\phi$  supply to the Yokagawa power meter in the  $3\phi$  4-wire mode. Use this to supply the  $3\phi$ , Y-connected load of  $300 \Omega$  in parallel with  $0.8 \text{ H}$ .

Attach CH1, CH2 and CH3 to phases A, B and C respectively. Attach the current probe to CH4. Set the supply to  $120 \text{ V}$  phase ( $208 \text{ V}$  line) and display all phase-neutral voltages. Have CH4 turned-off for the time being.

Compare the voltage magnitudes obtained from the scope with those from the Yokagawa. You will need to set the scope on **20X** for its probe; do this by pressing **CH1 MENU** then press **Probe 10X Voltage**, then press **Attenuation 20X**. Repeat for CH2 and CH3. Press **MEASURE** and adjust **Type** to **Cyc RMS** to read the voltage.

Press **MATH MENU** and adjust **Operation** to **Sources CH1 – CH2**. This will produce the line voltage  $V_{AB}$ . Confirm that this voltage magnitude is  $\sqrt{3}$  times bigger than the phase-neutral voltage and is  $30^\circ$  behind (why isn't it  $30^\circ$  ahead?)

Attach the current probe to phase C and turn-on CH4 to display  $I_C$ . Confirm that it is roughly  $45^\circ$  behind  $V_{CN}$ .

Return to **MATH MENU** and set **Operation** to **x** with **Sources** set to **CH3 x CH4**. Press **Application** and then press **Power Analysis**. Set **Sources** on **CH3 & CH4** and confirm the values of the quantities predicted in the pre-lab. Note that the Yokagawa presents total three-phase values while the scope presents single-phase values.

Write a conclusion that summarizes what you have learned.