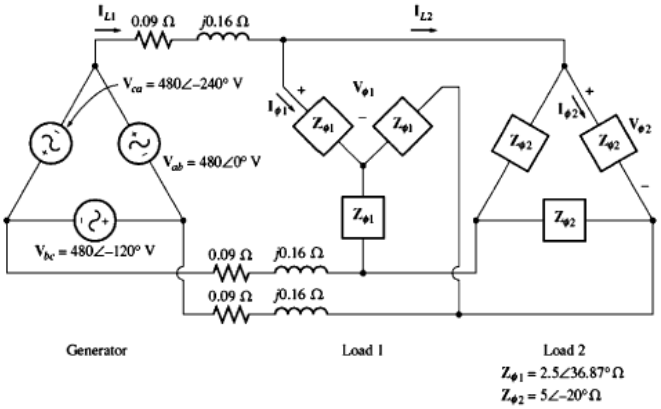
EE306 Energy Conversion
HW1 Due UT Classes Jan. 20th 2019; MW Classes Jan. 21st 2019

Problem 1:

Figure 1 shows a three-phase power system with two loads. The a-connected generator is producing a line voltage of 480 V, and the line impedance is 0.09 +j0.16Ω. Load 1 is Y connected, with a phase impedance of $2.5\angle 36.87°$ Ω and load 2 is a connected, with a phase impedance of $5\angle -20°\Omega$.

(a) What is the line voltage of the two loads?
(b) What is the voltage drop on the transmission lines?
(c) Find the real and reactive powers supplied to each load.
(d) Find the real and reactive power losses in the transmission line.
(e) Find the real power, reactive power and power factor supplied by the generator.



Problem 2:

Three balanced three-phase loads are connected in parallel. Load 1 is Y-connected with an impedance of 150 + $j50\Omega/\phi$; load 2 is Δ-connected with an impedance of 900 + $j600\Omega/\phi$; and load 3 is 95.04 kVA at 0.6 pf leading. The loads are fed from a distribution line with an impedance of 3 + $j24\Omega/\phi$. The magnitude of the line-to-neutral voltage at the load end of the line is 4.8 kV.

(a) Calculate the total complex power at the sending end of the line.
(b) What percent of the average power at the sending end of the line is delivered to the load?

Problem 3:

A three-phase source is supplying a balanced three phase load over a transmission line having impedance of Z_L=2+j20 ohms per phase. The voltage at the source end of the transmission line is $2887\angle 0$ volts line to neutral. The current supplied through the transmission line is $I_L=100\angle -30°$ amperes.

1. Determine the power factor seen by the source, and specify whether it is leading or lagging.
2. Determine the voltage (line to neutral) at the load.
3. Determine the power factor of the load, and specify whether the load is
   a. leading or lagging
   b. inductive or capacitive
4. Determine the real and reactive power consumed by the load.

Problem 4:

Figure 2 shows a one-line diagram of a small 480-V distribution system in an industrial plant. An engineer working at the plant wishes to calculate the current that will be drawn from the power utility company with and without the capacitor bank switched into the system. For the purposes of this calculation, the engineer will assume that the lines in the system have zero impedance.

(a) If the switch shown is open, find the real, reactive, and apparent powers in the system. Find the total current supplied to the distribution system by the utility.
(b) Repeat part (a) with the switch closed.
(c) What happened to the total current supplied by the power system when the switch closed? Why?