ELC470: Power Systems and Renewability
The College of New Jersey (TCNJ)
Department of Electrical and Computer Engineering (ECE)
Instructor: Anthony S. Deese, Ph.D.

Chapter #2 Project: Basic AC System Analysis

A. Matlab

Objective #1: Generate a Matlab function that accepts the following input [$\vec{V}_1, \vec{Z}_1, \vec{Z}_2, \vec{Z}_3, \vec{Z}_L$] and returns the amplitudes and phase angles of the following currents [$\vec{I}_1, \vec{I}_2, \vec{I}_L$] for the network below. You are encouraged to perform calculations in the phasor domain. Include this function (all m-file code as an appendix in your submission). What is the total real power loss (P_{Loss}) within the system in Watts?

$$\vec{V}_1 = 240V$$

$$\vec{Z}_1 = 10 + j5\Omega$$

$$\vec{Z}_2 = 1 + j1\Omega$$

$$\vec{Z}_3 = j2.5\Omega$$

$$\vec{Z}_L = 2 + j1\Omega$$

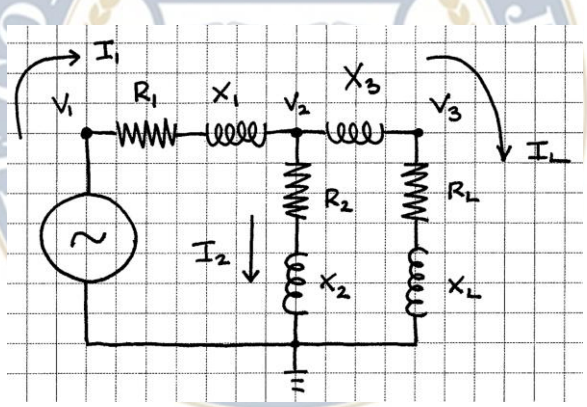

Figure 1: System Schematic

Objective #2: Calculate the complex or apparent power ($\vec{S}_L$) consumed by impedance Z_L. What value of X_{pfc} (placed in parallel with $\vec{Z}_L$) brings the power factor at bus #3 to unity?

Objective #3: Calculate the following currents [$\vec{I}_1, \vec{I}_2, \vec{I}_L$] within the updated network with power factor correction at bus #3. Update the complex or apparent power ($\vec{S}_L$) consumed by impedance Z_L as well as total real power loss (P_{Loss}) within the system?

Objective #4: Compare the ratio of P_{Loss}/P_L for the cases with and without power factor correction. Explain your results.

B. PSpice

Objective #5: Simulate this system in PSpice and verify your calculated results. Include screenshots of your simulation circuit and results. Compare PSpice results to that which you calculated.