Name ___________________________ **Date** ________ **Lab Section** ________

Introduction

In this exercise you will investigate the idea of power factor correction of a complex impedance.

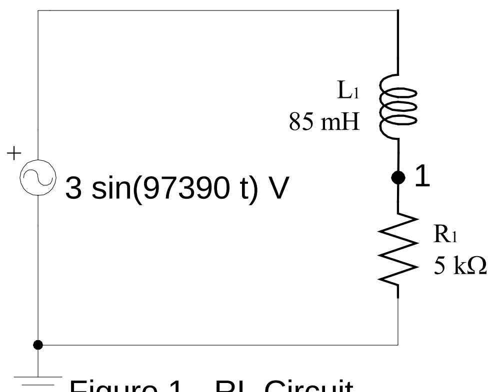

Figure 1 - RL Circuit

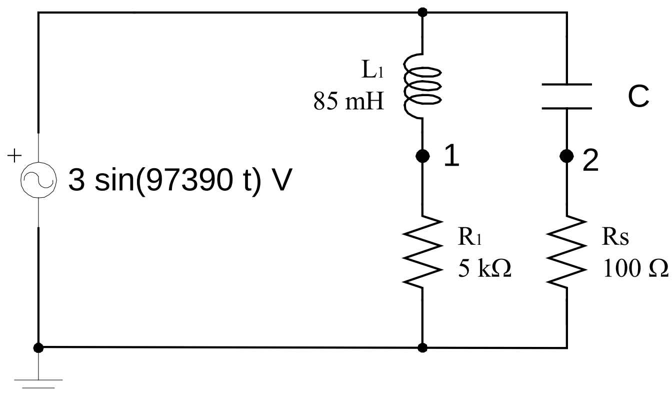

Figure 2 - Corrected Circuit

Prelab Calculations (Utilize Mathcad To complete before the laboratory session)

1. Calculate the source (and Load) current for the circuit shown in Figure 1.

   $I_{S\ (calculated)}$ = ______________________________ **A**

2. Calculate the capacitance (in parallel with the R-L load as shown in Figure 2) necessary to correct the power factor to unity, and calculate the corrected source current. Note: You may neglect the 100Ω sampling resistor in series with the capacitor for this calculation.

   C = ________________________ **F** **$I_{S\_new\ (calculated)}$ =** __________________________ **A**

Have your instructor verify your calculations and results. **Instructor:** _________

Procedure

1. Connect the circuit shown in Figure 1. This circuit will be used to model an R-L load (R_1 and L_1) connected to an ideal voltage source.

2. Energize your circuit and determine the source (and load) current by measuring the voltage across the 5000Ω load resistor (test point 1 in Figure 1).

$\mathbf{I_{S\ (measured)} = VR_1 / R_1 =}$ ______________________ **A**

3. Compare your measured current magnitude and angle to the theoretical prelab values.

$\mathbf{R_{d(mag)} =}$ ____________ **%** $\mathbf{R_{d(angle)} =}$ ____________ **%**

4. Add the capacitor into the circuit, as shown in Figure 2. Measure the load current and the capacitor current. A 100Ω sampling resistor had been added to allow the measurement of the capacitor current (test point 2 in Figure 2). Be sure to maintain the correct source voltage magnitude after the capacitor is added.

$\mathbf{I_C =}$ ______________________ **A** $\mathbf{I_{L\_new} =}$ ______________________ **A**

5. Measure the source current. **In order to perform this measurement, the sampling resistor must be placed in series with the source.** To adjust the circuit, remove the wire connecting R_1 to ground and then connect the opened terminal of R_1 to the connection point (test point 2) between the capacitor and the sampling resistor.

$\mathbf{I_{S\_corrected\ (measured)} =}$ ______________________ **A**

6. Compare the corrected source current that you just measured with the theoretical prelab value.

$\mathbf{R_{d(mag)} =}$ ____________ **%** $\mathbf{R_{d(angle)} =}$ ____________ **%**

Report Guide

1. Convert the series R-L load to an equivalent parallel Rp-Lp load.
2. Compare the impedance value (Xp) of the parallel equivalent inductance to the impedance value of the parallel capacitance (Xc) calculated during the prelab.
3. Redraw the original circuit (Figure 1) with the new parallel Rp-Lp loads added, and include the parallel power-factor-correcting capacitor. (You may leave out the 100Ω sampling resistors.)
4. Calculate the current through each of the components in the parallel circuit, using the capacitor value from prelab step 2, the Rp-Lp values from Report Guide step 1, and the original source voltage.
5. Draw a phasor diagram for each of the four currents.

Approved by (Instructor): ____________________________ Date: ________________