EE 221L Lab Experiment #2

**Topic:** Power Factor Correction

**Date:**

**Purpose:** The purpose of this lab is to familiarize the student with the lab equipment, and to demonstrate power factor correction.

**Preliminary:** In this lab, two circuits will be analyzed to determine the power factor. A capacitor bank will be added in parallel to the load to correct the power factor to the values listed below for both circuits. For each of the circuits, assume that the output from the voltage source is 60 Vrms at a frequency of 60 Hz.

Circuit 1: This load includes a 75 ohm resistor in series with a 180mH inductor (two 90mH inductors in series).

1. Calculate the complex power absorbed by the load and draw the power triangle.
2. Calculate the power factor of the circuit.
3. Calculate the value of capacitor required to give a power factor of 1.
4. Calculate the value of capacitor required to give a power factor > 0.95. NOTE: The overall impedance of the power factor corrected load must be inductive.
5. Determine the layout of the switches in the capacitor bank (described below) to correct the power factor to at least 0.95.

Circuit 2: This load includes a 50 ohm resistor in series with a 90mH inductor.

1. Calculate the complex power absorbed by the load and draw the power triangle.
2. Calculate the power factor of the circuit.
3. Calculate the value of capacitor required to give a power factor of 1.
4. Calculate the value of capacitor required to give a power factor > 0.99. NOTE: The overall impedance of the power factor corrected load must be inductive.
5. Determine the layout of the switches in the capacitor bank (described below) to correct the power factor to at least 0.99.

**Experimental:** The preliminary must be completed and signed off by the T.A. before proceeding to the experimental portion of the lab. Be careful not to get your hands across the power source! When connecting your circuit, start with the variac set at 0V and slowly turn up the voltage until the desired output is measured.
1. Construct the first circuit described above. The variac and power resistor used in lab 1 will be used in this lab to provide the source and resistance. Use two 90mH inductors in series to provide the 180mH inductance.

2. Measure the RMS voltage, RMS current and average power in the load.

3. Using these measured values, calculate the apparent power and power factor.

4. Add the capacitor bank designed in the preliminary in parallel to the load. Measure the new RMS voltage, RMS current and average power and compute the new apparent power and power factor.

5. Have your T.A. sign off your work before you tear down your circuit.

6. Repeat above for circuit 2.

**Capacitor Bank:** The capacitor bank consists of six switches connected to six capacitors, each with a value of 25uF. Setting the switches will result in the capacitors being connected in parallel or series with each other, or not connected at all. For example, setting all the switches to the right will result in the top capacitor being connected from red to black, giving a capacitance of one capacitor (25uF). Setting the top switch right, the second switch left and the last four open will result in the top two caps being in parallel with each other (50uF). Leaving the top switch open and setting the second switch to the right will result in the top two caps being in series with each other (12.5uF).