EE 340L
EXP: 2 – THREE-PHASE AC CIRCUITS

A. Determining the Phase Sequence

One way to determine the phase sequence is to use two light bulbs and a capacitor connected in Wye as shown in Fig. 1.

1. Let the phase voltage be 120 V, the capacitor value is 4 μF, and the resistance value of each of each light bulb is 4 kΩ. Further assume that the phase sequence is A-B-C. Calculate the voltage across the light bulb connected to phase B, and the voltage across the light bulb connected to phase C. Which of the two bulbs should be brighter?
2. Repeat 1) above by assuming the phase sequence is A-C-B. From the results of 1) and 2), one can conclude that the phase sequence is in the following order: bright lamp – dim lamp – capacitor.
3. Verify the above experiment in the laboratory.

B. Power Measurement by 2-Wattmeter Method.

A three-phase 208 V circuit supplies power to an unbalanced 3-wire, delta connected resistive load. The resistance branches are as follows: 150 Ohms, 300 Ohms and 600 Ohms.

1) Calculate the total power delivered to the load.
2) Two watt-meters are used to measure the power above (using one of the phases as a reference to the voltage). Calculate the power measured by each of these meters.
3) Verify your calculations above through a laboratory experiment.

C. Load Balancing.

When a single-phase resistive (R) load is connected across two phases of a three-phase source, it creates a highly unbalanced system (i.e., two of the line currents are equal but opposite in phase, while the third line current is zero). It is possible to balance this circuit perfectly (i.e., all line currents are equal, and in phase with their respective phase voltages) by using an inductor and capacitor with specific values as shown in Fig. 2. Further, it is essential that the phase sequence should be 1-2-3.
1) Suppose that the three-phase source is 208 V and $R = 150$ Ohms. Calculate the magnitude and phase angle of line currents when (a) the single-phase load is connected alone, and (b) when the balancing LC circuit is added.

2) Verify the above through a laboratory experiment (hint: use combination of available L and C values in the Laboratory to closely match the desired values).

![Figure 1](image1.png)

![Figure 2](image2.png)