KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Electric Engineering Department

| EE 306   Electric Energy Engineering - Experiment#1 |

THREE PHASE CIRCUITS

Objectives:

- To learn how to make wye **(Y)** and delta **(Δ)** connections
- To study the relationship between voltage and current in three phase circuits.
- To make power calculations.

Apparatus:

- 2 AC voltmeters
- 2 AC Ammeters
- 1 3Φ- load
- 1 3Φ variable AC power supply

Theory :

In a Y connection , the line and the phase quantities are related by:

$$V_p = V_L/\sqrt{3} \qquad (1)$$

$$I_p = I_L \qquad (2)$$

Whereas the relationships for a delta connection are

$$I_p = I_L/\sqrt{3} \qquad (3)$$

$$V_p = V_L \qquad (4)$$

The real and reactive powers for a 3 Φ circuit (either Y or Δ connection) are given as

$$P = \sqrt{3}\ V_L\ I_L\ \cos\theta \qquad (5)$$

$$Q = \sqrt{3}\ V_L\ I_L\ \sin\theta \qquad (6)$$

Where θ is the power factor angle of the balanced load

Procedure:

A: Y – Connection

1. Connect the three-phase load in Y as shown in Fig. 1. Ask your instructor to check your connections.
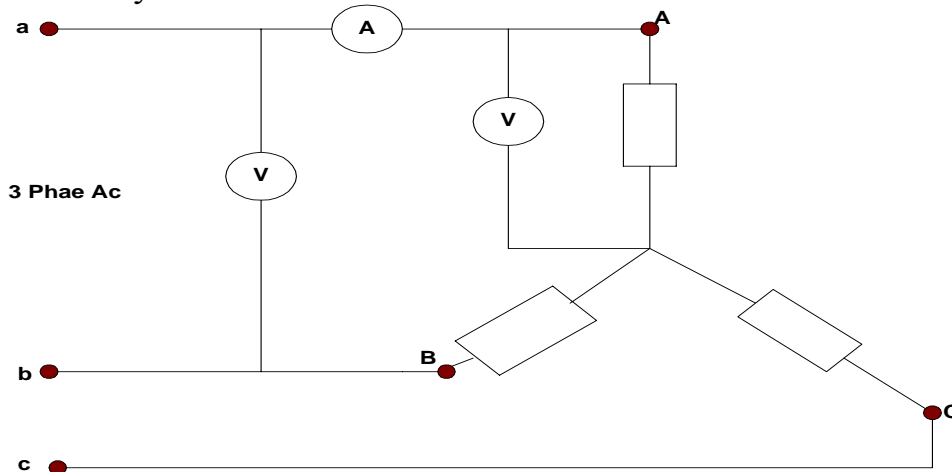

Fig. 1 :   The Y - Connection

2. Switch the load to unity power factor mode
3. Select the balanced load from each phase
4. With the load switch off turn the power supply on and adjust the line to neutral voltage to 120 volt or $V_L = 208$ volt
5. Measure the line and phase voltages and currents. Make the table similar to table1 on a separate page and enter your readings in the first 4 columns

Table 1: Y connecteds load

V_L	V_p	I_L	Ip	V_L / V_p	I_L / Ip	P	Q	Remarks

Take three readings, one at <u>the rated value of the load current (8A)</u>, one at ½ rated load and one at ¼ rated.

6. Repeat step 5 for 0.8 and 0.8 leading power factor loads

B: Δ Connection

1. Connect the three phase load as shown in fig. 2
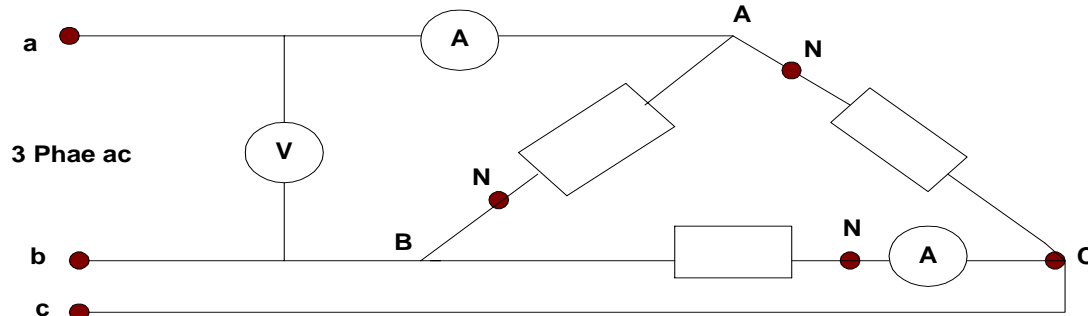

Fig. 2 :   The Delta- Connection

2. Turn the power supply on and adjust for 120V A.C (Note: $V_p = V_L$ for Δ)
3. Repeat step 5 of the Y connection for unity, 0.8 lagging and 0.8 leading power factors and enter in a table similar to table 1, call it table 2.

Report

1. Complete tables 1 and 2.
2. Calculate the total real and reactive powers.
3. Draw phasor diagrams showing the line and phase voltages and currents for both Y and Δ connections. Draw only for rated load, unity power factor condition.
4. Verify the relationships for the phase and the line voltages and currents and state reasons for any errors.