KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Electrical Engineering Department

EE 208 ELECTRICAL SYSTEMS

Experiment # 9 THREE PHASE CIRCUITS

OBJECTIVE:

1- Learn how to make **wye (Y)** and **delta** (**Δ**) connections.

2- Study the **relationship** between voltage & current in **three phase** circuits.

3- Make power calculations.

APPARATUS: AC Power Supply
Ohmmeter, 2 - AC Voltmeter and 2 - AC Ammeter
1 - 3Φ load & 1 - 3Φ variable AC power supply

THEORY:

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

$$V_P = V_L / \sqrt{3} \quad (1)$$

$$I_P = I_L \quad (2)$$

Whereas the relationships for a **delta connection** are:

$$I_P = I_L / \sqrt{3} \quad (3)$$

$$V_P = V_L \quad (4)$$

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

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

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

Where the angle θ is the phase difference between the voltage and the current of the balanced load. The voltages & the currents in the equations are in rms values.

PROCEDURE:

A: Y – Connection

1. Connect the three-phase load as the **Y** connected load shown in Figure 1. Have your connections checked by the instructor.
2. With the load switch **turned off,** switch the power supply **on** and adjust the line to neutral voltage to **120 volts** or V_L = 208 volts.
3. Switch the load to **unity power** factor mode.
4. Select the **balanced** load from each phase.
5. Measure the **line** and the **phase voltages** as well as **currents**. Record the values in Table 1.

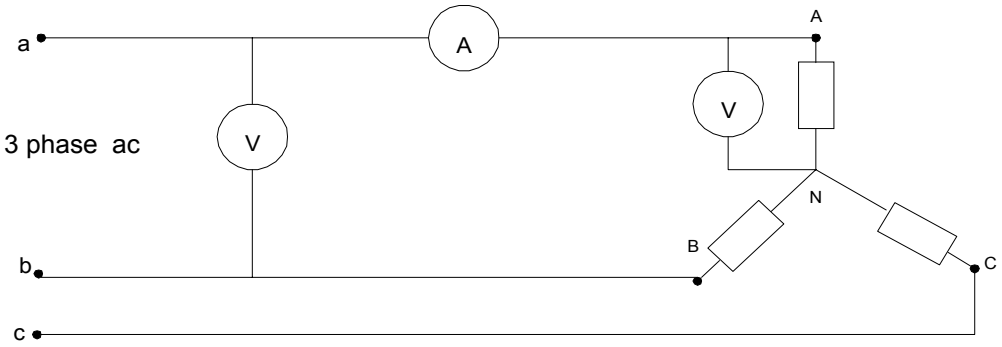

Figure 1: The Y – Connection

6. Take **three readings**, one at the **rated value** of the load (i.e. current = 8A), one at **½ rated** load and one at **¼ rated**.
7. **Repeat** step 5 and 6 for power factor loads of **0.8 lagging** and **0.8 leading**.
8. **Turn** the load switch **off.**
9. Then **turn** the **power** supply **switch off** and adjust its voltage to **0 volts.**

B: Δ Connection

1. Connect the three-phase load as the Δ connected load shown in Figure 2.

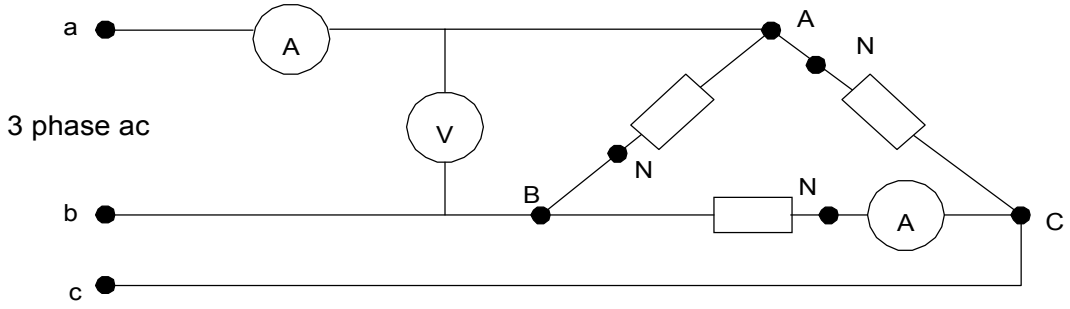

Figure 2: The Δ Connection

2. With the load switch **turned off,** switch the power supply **on** and adjust the line to neutral voltage to **120 V AC** ($V_L = V_P$ for **Δ**).
3. Switch the load to **unity power factor** mode.
4. Select the **balanced** load from each phase.
5. Measure the **line** and the **phase voltages** as well as **currents**. Record the values in Table 2.
6. Take **three readings**, one at the **rated value** of the load (i.e. current = 8A), one at **½ rated** load and one at **¼ rated**.
7. **Repeat** step 5 and 6 for power factor loads of **0.8 lagging** and **0.8 leading**.
8. **Turn** the load switch **off.**
9. Then **turn** the **power** supply **switch off** and adjust its voltage to **0 volts.**

REPORT:

1. **Complete** Tables 1 and 2.
2. **Calculate** the total real and reactive powers in Tables 1 and 2.
3. **Verify** the **relationships** for the phase and the line voltages and currents and state reasons for any errors.

EXPERIMENT # 9 Laboratory Report

Name: ..... **I.D.** ..... **Lab. Section:** .....

TABLE 1

Y Connected load

PF	V_L	V_P	I_L	I_P	V_L/V_P	I_L/I_P	P	Q
1.0								
1.0								
1.0								
0.8 Lagging								
0.8 Lagging								
0.8 Lagging								
0.8 Leading								
0.8 Leading								
0.8 Leading								

Δ Connection load

PF	V_L	V_P	I_L	I_P	V_L/V_P	I_L/I_P	P	Q
1.0								
1.0								
1.0								
0.8 Lagging								
0.8 Lagging								
0.8 Lagging								
0.8 Leading								
0.8 Leading								
0.8 Leading								