DEPARTMENT OF ELECTRICAL ENGINEERING
FIRST YEAR E.T. LAB EXP. NO. – 4

THREE PHASE POWER MEASUREMENT

OBJECTIVES:

To measure power in a three phase circuit under

i) balanced resistive load condition.
ii) balanced reactive load condition.
iii) unbalanced resistive load condition.
iv) unbalanced reactive load condition.

BALANCED LOAD

CIRCUIT DIAGRAM

(A) Resistive Circuit:

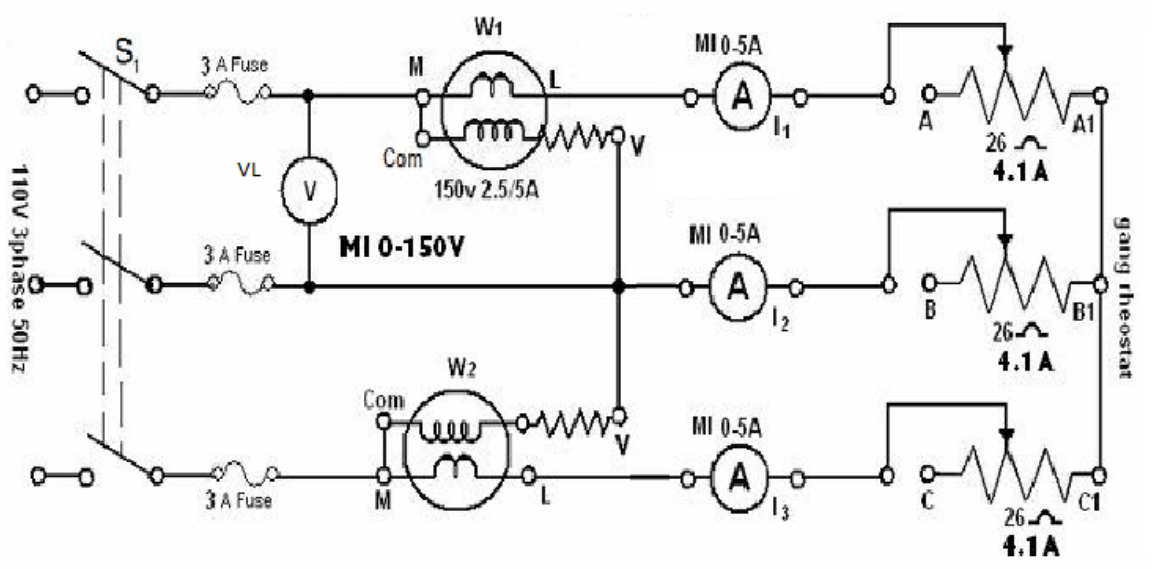

Fig.1

PROCEDURE:

1. Connect the circuit as shown in Fig.1
2. Adjust the ganged rheostat for the maximum resistance.
3. Close switch S1.
4. Read the meters to obtain V_L, I_1, I_2 and I_3. Note the wattmeter reading W_1 and W_2 (Note the multiplying factor.).
5. Vary the load resistance and obtain at least three sets of observations, the current should not exceed the limit (4.1 A).
6. Tabulate the readings and check the results by completing the calculations indicated in the table.
7. For any one above situation, measure the voltage between neutral and the start point of the rheostat connection and note it down.

OBSERVATION TABLE – 1 (Three phase power in a balanced resistive load)

Sl. No.	V_L (V)	I_1 (A)	I_2 (A)	I_3 (A)	W_1 (W)	W_2 (W)	Calculated power (Wc)= $(V_L / \sqrt{3})$x $(I_1+I_2+I_3)$	$W_m = (W_1 + W_2)$	Error $\frac{Wm - Wc}{Wc}$ x 100%

(B) Capacitive Circuit:

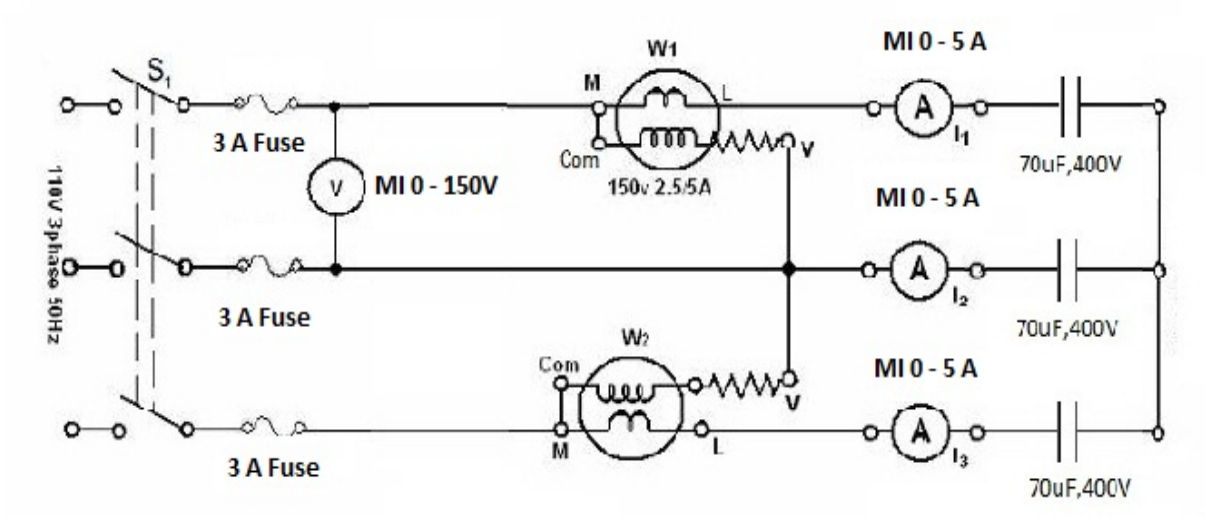

Fig.2

PROCEDURE:

1. Connect the circuit as shown in Fig.2
2. Switch on the supply.
3. Close switch S1.
4. Read the meters to obtain V_L, I_1, I_2 and I_3. Note the wattmeter readings W_1 and W_2 with proper sign. Calculate W=W1+W2 (Note the multiplying factor.)
5. Measure the voltage between neutral and the start point of the capacitor connection and note it down.

OBSERVATION TABLE – 2 (Three phase power in a balanced capacitive load)

Sl. No.	V_L (V)	I_1 (A)	I_2 (A)	I_3 (A)	W_1 (W)	W_2 (W)	Error= (W1 + W2)

UNBALANCED LOAD

CIRCUIT DIAGRAM

(A) Resistive Circuit:

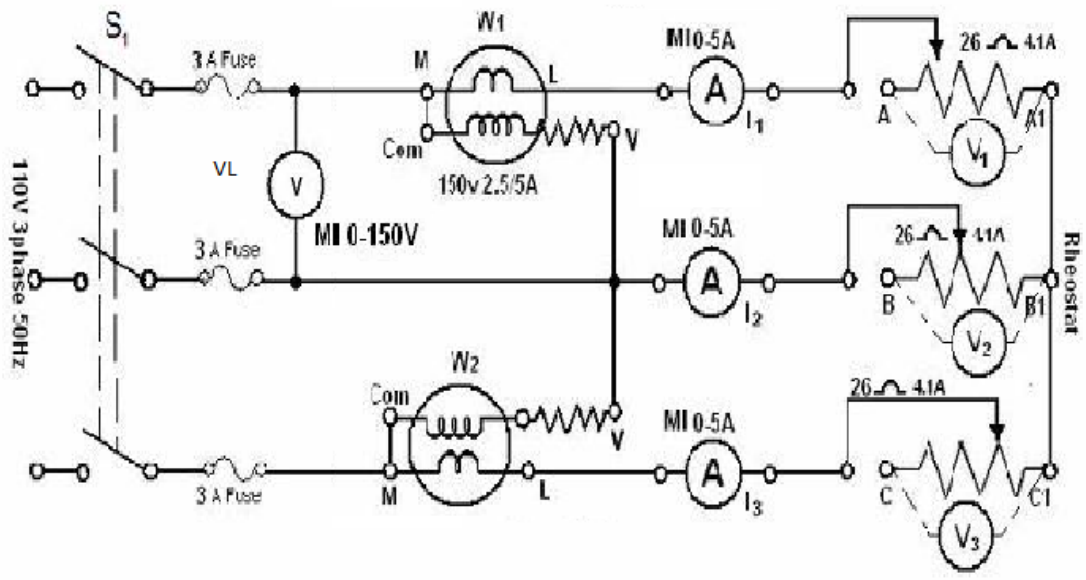

Fig.3

PROCEDURE:

1. Connect the circuit as shown in Fig.3.
2. Use three separate rheostats of 26 Ω, 4.1A and connect in a star.
3. Adjust the three rheostats at the maximum values.
4. Close switch S1 and take three sets of observation for different rheostat settings such that the reading of I_1, I_2 and I_3 in each set is appreciably different to create unbalanced loading condition. The current should not exceed the limits in each arm.
5. Tabulate and check the results by completing the computations indicated in Table-3.

6. For any one above situation, measure the voltage between neutral and the star point of the rheostat connection and note it down.

OBSERVATION TABLE – 3 (Three phase power in an unbalanced resistive load)

Sl. No.	V_1 (V)	V_2 (V)	V_3 (V)	I_1 (A)	I_2 (A)	I_3 (A)	W_1 (W)	W_2 (W)	Calculated Power Wc $=V_1I_1+V_2I_2+V_3I_3$	W_m = (W_1+W_2)	Error $\frac{Wm - Wc}{Wc}$ X 100%

(B)Capacitive Circuit:

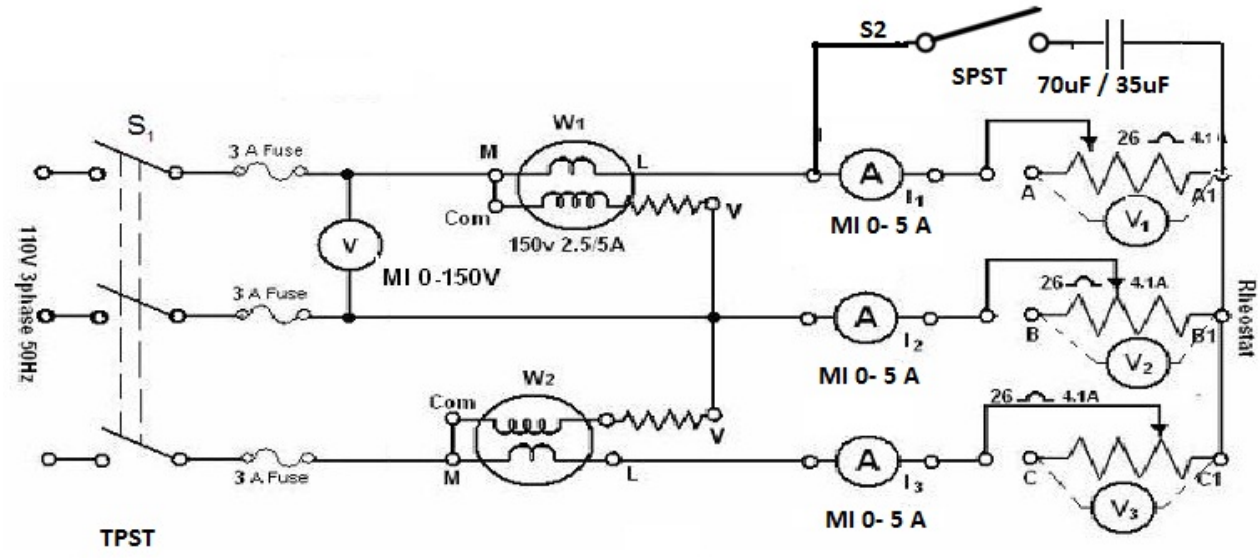

Fig.4

PROCEDURE:

1. Connect the circuit as shown in Fig.4
2. Adjust the three rheostats at the maximum values.
3. Close switch S1 and S2 and note down the readings for two cases (70uF and 35 uF).
4. Tabulate and check the results after completing the computations as in Table:-4.
5. For any one above situation, measure the voltage between neutral and the star point of the rheostat connection and note it down.

OBSERVATION TABLE – 4 (Three phase power in an unbalanced load with capacitor)

Capacitance	V_1 (V)	V_2 (V)	V_3 (V)	I_1 (A)	I_2 (A)	I_3 (A)	W_1 (W)	W_2 (W)	Calculated Power Wc $=V_1I_1+V_2I_2+V_3I_3$	Wm = (W_1+W_2)	Error $\frac{Wm - Wc}{Wc}$ x 100%
70uF											
35uF											

Special Precaution- Discharge the capacitors before further connection.

DISCUSSION:

1. What do you understand by a balanced three-phase load?
2. How would you measure power using a) Three watt meters and b) One wattmeter for balanced/unbalanced loads?
3. Is it possible to measure power factor of the balanced (three –phase load by two-wattmeter method)?
4. Draw the phasor diagrams for the four situations in the experiment.
5. Incase S2 is open in Fig.4 for case 1 (70uF), will the wattmeter readings change? Discuss.
6. Comment on the neutral to start point voltage for each case.