

Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology



Course Title

Circuit and System -II Sessional

Course No : ECE 1202

Lab Report No : 03

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Experiment No : 03

Experiment Nme :

Measurement of Power in a Three-Phase Balanced System using two wattmeter method.

Submitted To:	Submitted By:
Oishi Jyoti Assistant Professor Dept. Of Electrical & Computer Engineering	Name :Mahmudul Hasan Roll :2210057 Registration :1111 Session :2022-2023 Department of ECE,RUET

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Experiment No:03

Name of The Experiment:

Measurement of Power in a Three-Phase Balanced System using two wattmeter method.

Objectives:

1. To learn how to measure power of three phase system using two wattmeter

Required Apparatus:

1. Voltmeter and wattmeters.
2. Ac Voltage Source
3. Ammeter
4. Resistors
5. Connecting Wires

Theory:

If two wattmeter are connected to measure the power of any three phase load, it can be shown that the wattmeter read ,

$$P_1 = V_L I_L \cos(30^\circ - \alpha) \text{ -----(1)}$$

$$P_2 = V_L I_L \cos(30^\circ + \alpha) \text{ -----(2)}$$

Where α is the power factor angle of the load .From equation (1) and (2) we can write that ,

$$P_T = P_1 + P_2 = \sqrt{3} V_L I_L \cos(\alpha) \text{ -----(3)}$$

Circuit Diagram:

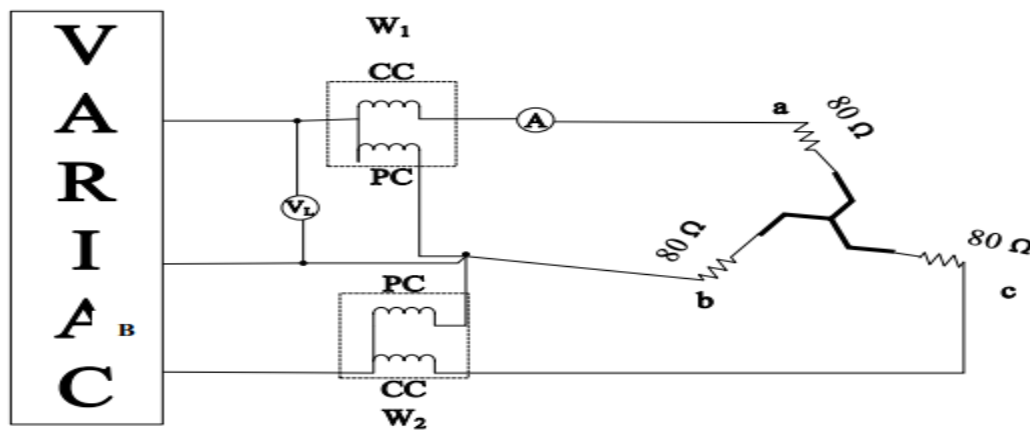


Fig : A balanced 3 – ϕ system with two wattmeters

Procedure:

1. Using the necessary components, a circuit was built by following the circuit diagram.
2. The ammeter and voltmeter were connected according to the diagram and wattmeter.
3. Voltmeter and ammeter and wattmeter readings were recorded into a data table, and an error calculation was made.

Calculation:

Reading 1:

First wattmeter reading, $P_1 = 22 \text{ W}$

Second wattmeter reading, $P_2 = 28 \text{ W}$

Measured total power = $P_1 + P_2 = 60 \text{ W}$

Line voltage, $V_L = 72.5 \text{ V}$

Line current, $I_L = 0.53 \text{ A}$

Calculated total power = $\sqrt{3}V_L I_L \cos\theta = 66.554 \text{ W}$

Error = 24.87%

Reading 2:

First wattmeter reading, $P_1 = 28 \text{ W}$

Second wattmeter reading, $P_2 = 32 \text{ W}$

Measured total power = $P_1 + P_2 = 60 \text{ W}$

Line voltage, $V_L = 79.9 \text{ V}$

Line current, $I_L = 0.609 \text{ A}$

Calculated total power = $\sqrt{3}V_L I_L \cos\theta = 84.28 \text{ W}$

Error = 28.8 %

Reading 3:

First wattmeter reading, $P_1 = 36 \text{ W}$

Second wattmeter reading, $P_2 = 40 \text{ W}$

Measured total power = $P_1 + P_2 = 76 \text{ W}$

Line voltage, $V_L = 87.4\text{V}$

Line current, $I_L = 0.666\text{ A}$

Calculated total power $= \sqrt{3} V_L I_L \cos\theta = 100.208\text{ W}$

Error = 24.69 %

Reading 4:

First wattmeter reading, $P_1 = 45\text{ W}$

Second wattmeter reading, $P_2 = 48\text{ W}$

Measured total power = $P_1 + P_2 = 93\text{ W}$

Line voltage, $V_L = 94.8\text{V}$

Line current, $I_L = 0.726\text{ A}$

Calculated total power $= \sqrt{3} V_L I_L \cos\theta = 119.20\text{ W}$

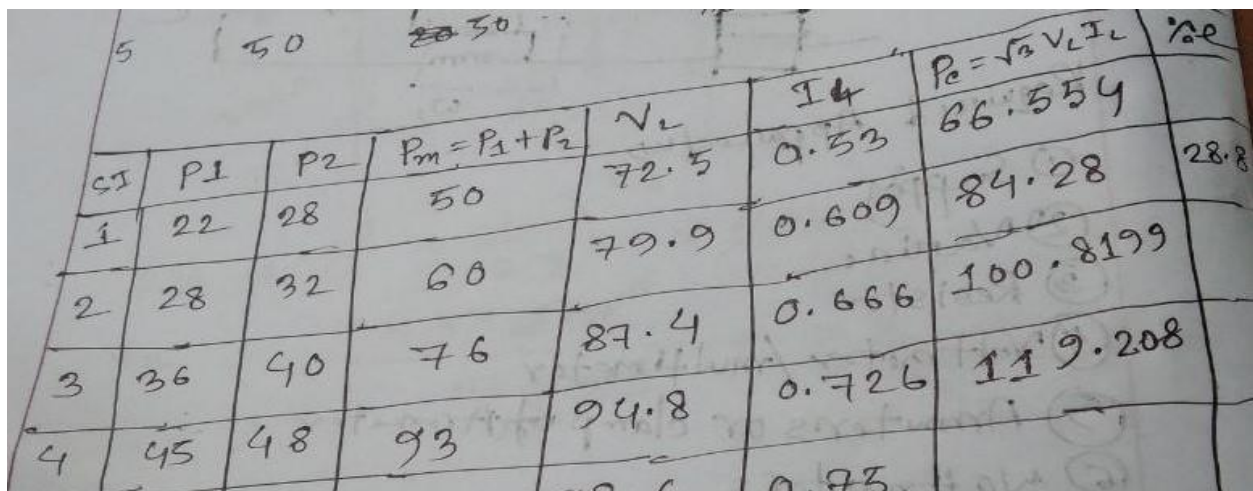
Error = 21.98 %

\therefore Average error = $(24.87+28.8+24.69+21.98)/4 = 25.085\%$

Data Table:

Sl	P ₁	P ₂	P _m =P ₁ +P ₂	V _L	I _C	P _C = $\sqrt{3}V_L I_C$	Error(%)
1	22	28	50	72.5	0.53	66.554	24.87
2	28	32	60	79.9	0.609	84.28	28.8
3	36	40	76	87.4	0.666	100.8199	24.69
4	45	48	93	94.8	0.726	119.208	21.98

Data From Lab:



Sl	P ₁	P ₂	P _m =P ₁ +P ₂	V _L	I _L	P _C = $\sqrt{3}V_L I_L$	%e
1	22	28	50	72.5	0.53	66.554	24.87
2	28	32	60	79.9	0.609	84.28	28.8
3	36	40	76	87.4	0.666	100.8199	24.69
4	45	48	93	94.8	0.726	119.208	21.98

Result:

From the data table ,we can see that the result is almost same as we expected though it shows some error but that was very small.

Average error =25.085 %

Discussion:

The experiment successfully verified if we ignored the small error.we can get the total power of a system using two wattmeter easily that helps to save our metarial cost.