Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering.

Lab report

Course Code : ECE 1202

Course Title : Circuits and System-II Sessional

Date of Experiment :10/09/2024

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Submitted To:	Submitted By:
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Experiment No. 03

Experiment Name: Power Measurement of a Balanced 3-Phase System Using the Two Wattmeter Method.

Objective:
To understand and analyze the measurement of power in a balanced three-phase system using the two-wattmeter method and verify the theoretical relationships experimentally.

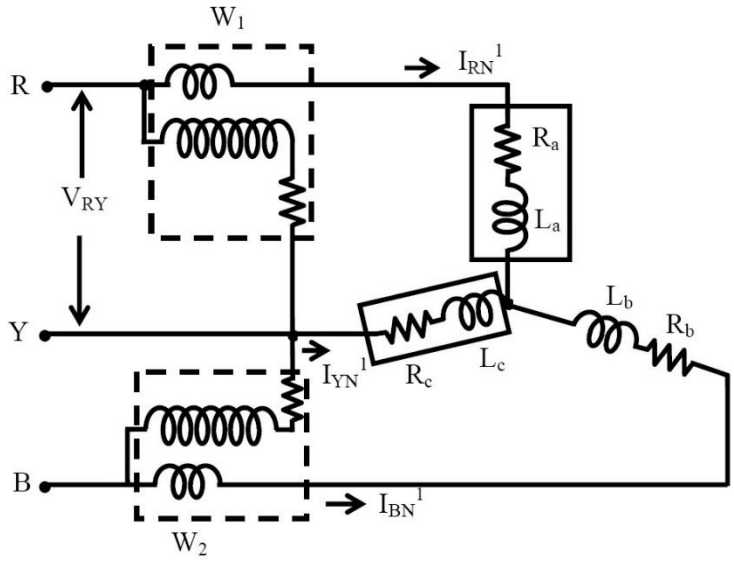
Theory:
In a three-phase electrical system, power measurement can be achieved using the two-wattmeter method, especially in balanced and unbalanced loads. The two-wattmeter method uses two wattmeters connected in a way that they can measure power even if the system is unbalanced. The total power in a balanced three-phase system is the sum of the readings of the two wattmeters.

- **Wattmeter Readings (P1 and P2):**
  These measure power delivered to the load from two different lines of the three-phase system.
- **Total Power (P):**
  The total power delivered to the load in a balanced system can be calculated by adding the readings of the two wattmeters: P=P1+P2.

Required Apparatus:

- Three-phase AC power supply.
- Balanced three-phase load (resistors).
- Two wattmeters.
- Voltmeter.
- Ammeter.
- Connecting wires.
- VARIAC.
- Multimeter.

Circuit Diagram:



Procedure:

1. Set up the circuit with two wattmeters connected as per the two-wattmeter method configuration for three-phase power measurement.
2. Ensure that the load is connected in a balanced three-phase configuration.
3. Apply the three-phase voltage using the AC power supply and gradually increase it using the VARIAC.
4. Record the readings of both wattmeters (P1 and P2).
5. Measure the line voltage (V_Line) and the line current (I_Line) using the voltmeter and ammeter, respectively.
6. Calculate the total power using the sum of the two wattmeter readings

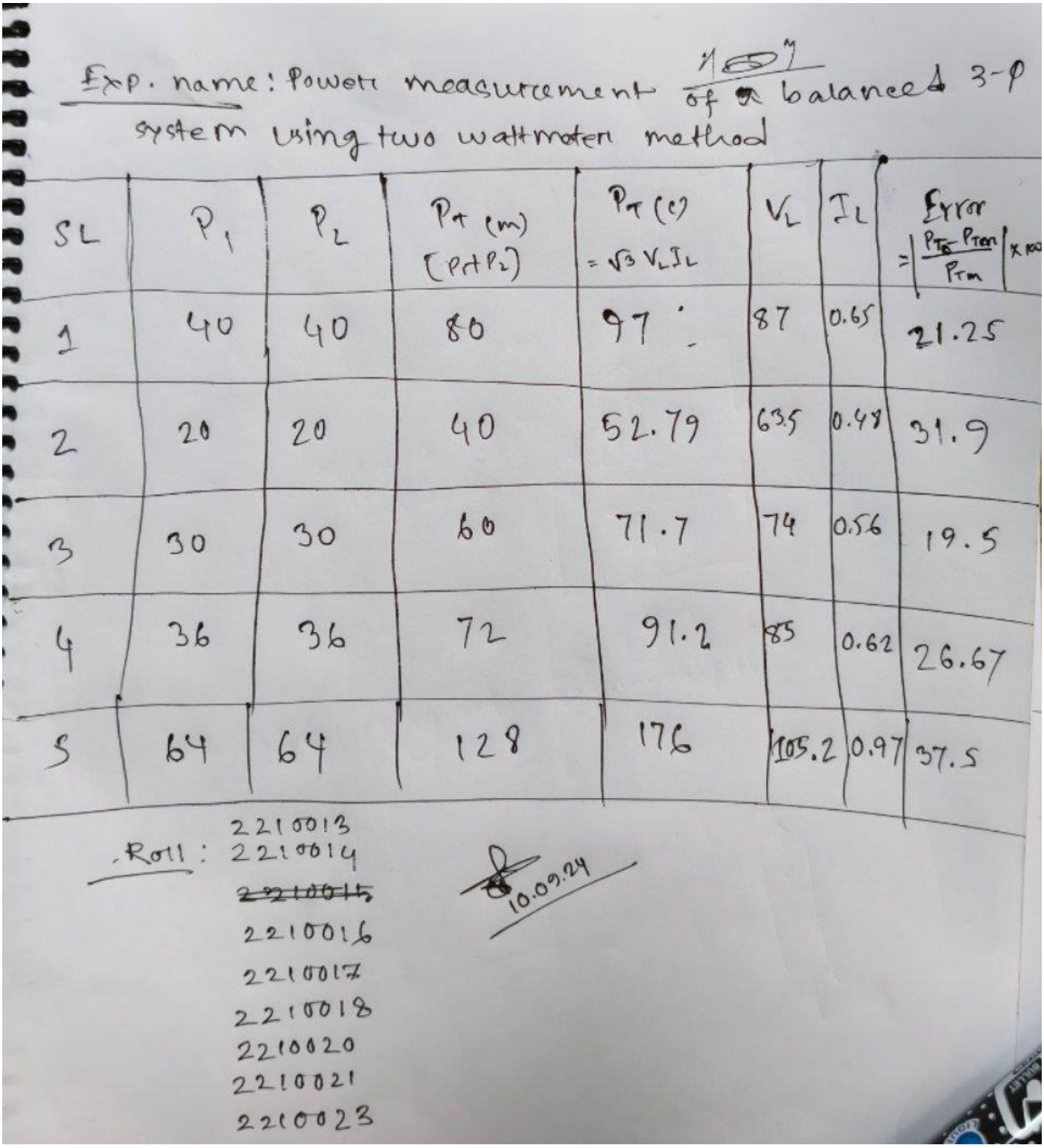
Data Table:

Serial No	**P_1**	**P_2**	**P_T(m) (P_1+P2)**	**P_T(c)= $\sqrt{3}$ $V_L I_L$**	**V_L**	**I_L**	**Error = $\lvert(P_{Tc}-P_{Tm})/P_{Tm}\rvert$ *100%**
1	**40**	**40**	**80**	**97**	**87**	**.65**	**21.25**
2	**20**	**20**	**40**	**52.79**	**63.5**	**.42**	**31.6**
3	**30**	**30**	**60**	**71.7**	**74**	**.56**	**19.5**
4	**36**	**36**	**72**	**91.2**	**74**	**.62**	**26.67**
5	**64**	**64**	**128**	**176**	**105.2**	**.97**	**37.5**

Result: The experimental measurements show that the total power calculated using the two-wattmeter method closely matches the expected values based on the theoretical calculations. The minor errors observed can be attributed to measurement inaccuracies, losses in the circuit, or external factors.

Discussion: Ignoring the small margin of errors which may have caused due to internal or external factors, the experiment was a success.

Data table from actual lab experiment:



Exp. name: Power measurement of a balanced 3-ϕ system using two wattmeter method

SL	P_1	P_2	P_T (m) (P_1+P_2)	P_T (c) $=\sqrt{3}V_L I_L$	V_L	I_L	Error $=\left\|\frac{P_{Tc}-P_{Tm}}{P_{Tm}}\right\| \times 100$
1	40	40	80	97	87	0.65	21.25
2	20	20	40	52.79	635	0.48	31.9
3	30	30	60	71.7	74	0.56	19.5
4	36	36	72	91.2	85	0.62	26.67
5	64	64	128	176	105.2	0.97	37.5

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