University of Al-Mustaqbal
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Magnetism

the practical aspect

Second Stage

Wheatstone Bridge

Lec 9

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The objective of the experiment :

The Wheatstone Bridge experiment aims to:

1. Accurately measure an unknown resistance.
2. Understand the balance condition in electrical circuits.
3. Apply Ohm's Law and the voltage divider principle.
4. Learn the comparison method for resistance measurement.
5. Use the galvanometer as an indicator of imbalance.

Equipment used in the experiment :

- Wheatstone Bridge board
- Unknown resistance **Rx**
- Known resistors **R1, R2, R3**
- DC power supply (3–6 V)
- Galvanometer
- Connecting wires
- Multimeter (if needed)

Theory of the Experiment:

The Wheatstone Bridge is a circuit used to compare an unknown resistance with known resistors under the balance condition.

The bridge consists of four resistors arranged in a diamond shape.
At balance:

R1/R2 = $R_\chi/R3$

The galvanometer current becomes:

$$I_g = 0$$

Thus, the unknown resistance is:

$$R_\chi = R1R3/R2$$

Where:

- (R_χ): Unknown resistance
- (R1, R2, R3): Known resistors
- (I_g): Galvanometer current (zero at balance)

The method of work :

1. Connect the resistors (R1, R2, R3) to the Wheatstone Bridge board.
2. Connect the unknown resistor **Rx** in its proper position.
3. Connect the galvanometer between the middle nodes of the bridge.
4. Connect the DC power supply (3–6 V) to the bridge.
5. Adjust (R3) (or choose different values of R1 and R2) until the galvanometer reads zero.
6. Record the resistor values at balance.

7.Calculate the unknown resistance using:

$$R_\chi = R1R3/R2$$

8. Repeat the experiment for several sets of values to obtain an average measurement.
9. Compute the percentage error:

$$\text{Error \%} = \left|R_{actual} - R_\chi/R_{actual}\right|$$

Trial No.	R1 (Ω)	R2 (Ω)	R3 (Ω)	Galvanometer Reading	Balanced?	Calculated Rx (Ω)
1						
2						
3						
4						
Average						

Discussion

1. The Wheatstone Bridge is mainly used for:

A) Voltage measurement
B) Accurate resistance measurement

C) Power measurement
D) Current measurement
E) Frequency measurement

2. Balance in the Wheatstone Bridge occurs when:

A) Maximum current flows
B) Supply voltage becomes zero
C) All resistances are equal
D) Galvanometer current becomes zero
E) R1 + R2 = Rx + R3

3. The balance condition is given by:

A) (Rx = R1 + R2)
B) (Rx = R_3 + R_1)
C) (Rx = R3 R1/R2})
D) (Rx = R1 R2 R3)
E) (Rx = R1/R3)

4. The galvanometer is used to measure:

A) Resistance
B) Power
C) AC current only
D) Zero current at balance
E) High voltage

5. If R1 = 100 Ω, R2 = 50 Ω, R3 = 200 Ω, then Rx = ?

A) 100
B) 200
C) 300
D) 400
E) 50

6. The purpose of the DC supply in the bridge is to:

A) Power the galvanometer
B) Provide current for the bridge
C) Increase resistance

D) Balance the resistors
E) Measure power

7. Increasing R2 while keeping R1 and R3 constant causes Rx to:

A) Increase
B) Decrease
C) Stay the same
D) Become equal to R3
E) Become zero

8. The Wheatstone Bridge consists of:

A) Three resistors
B) One resistor
C) Four resistors
D) Five resistors
E) Only a battery

9. If the bridge is not balanced, it means:

A) The bridge is burnt
B) The galvanometer is broken
C) Galvanometer current ≠ zero
D) The supply is too weak
E) R1 = R2

10. For accurate measurement of Rx, you must:

A) Always set R1 = R2
B) Keep the bridge unbalanced
C) Record random values
D) Make the galvanometer read zero
E) Disconnect the supply

11. Known resistors are used because:

A) They change automatically
B) Their values are precise
C) They provide higher current
D) They need no power
E) They produce less heat

12. When the bridge is unbalanced:

A) Rx cannot be calculated
B) Rx can be calculated but less accurately
C) Rx = R1 + R2
D) Rx = R3 always
E) Voltage becomes zero

13. The essential component of the Wheatstone Bridge is:

A) Capacitor
B) Transformer
C) Galvanometer
D) Motor
E) Coil

14. At balance, the voltage between galvanometer terminals is:

A) Maximum
B) Zero
C) Half the supply voltage
D) Equal to the bridge current
E) Depends on R3

15. To increase measurement accuracy, you should:

A) Use a high supply voltage
B) Use random resistors
C) Use precision resistors
D) Remove the galvanometer
E) Increase temperature