**Al- Mustaqbal University**

**College of Science**

**Medical Physics Department**

**First Stage**

جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

# Practical Electrical Lab

# Lecture TWO : Wheatstone Bridge

*MS.c Israa hussein*

*MS.c hussein ali*

*B.Sc Mohammed Jamal*

**2025 – 2026**

## Wheatstone Bridge

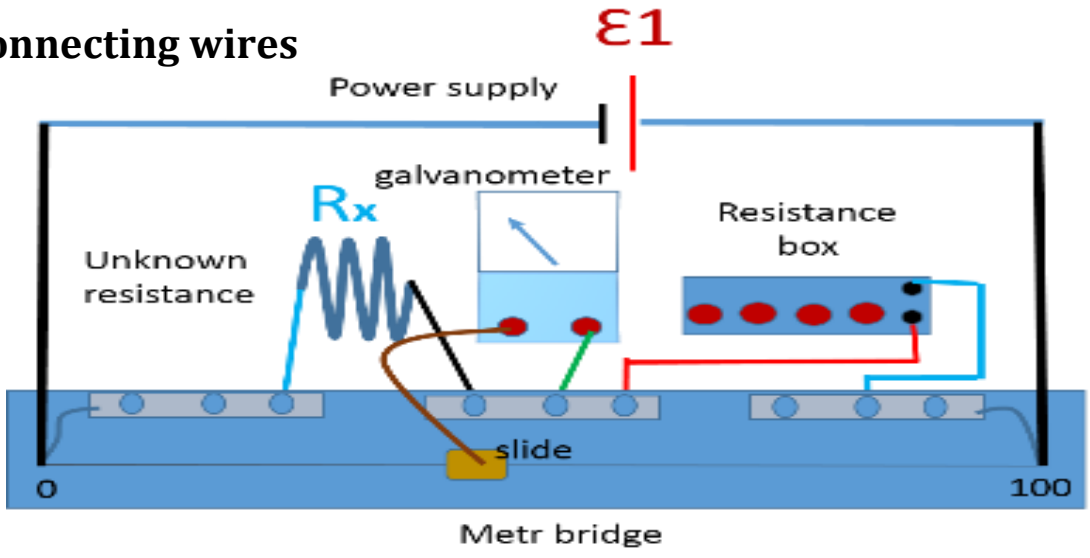
**In the year 1843 AD, the English physicist Charles Wheatstone (1802 – 1875) made an electrical circuit to measure the amount of unknown resistance. This circuit was distinguished by its high accuracy in finding the amount of resistance. It relied on finding the value of the unknown resistance in proportion to the values of known resistors.**

## Aim of the Experiment

**It is to find the amount of unknown resistance.**

## Tools and Equipment Used

1. **Power supply**
2. **Unknown resistance**
3. **Galvanometer**
4. **Resistance box**
5. **Moving slide**
6. **Metric bridge (100 cm long)**
7. **Connecting wires**



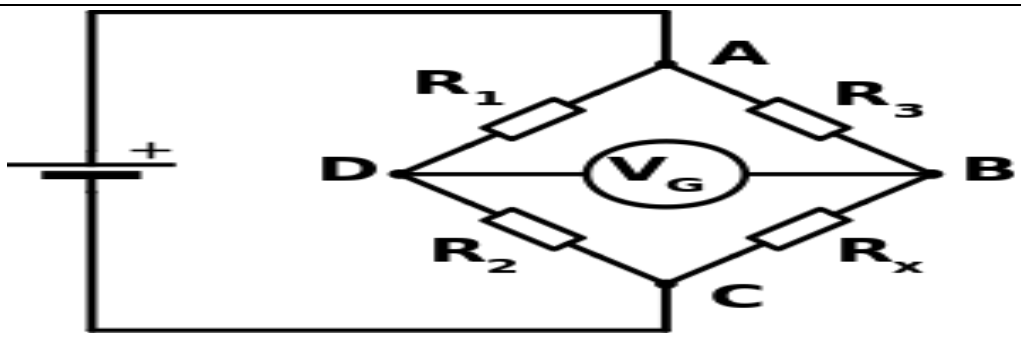



Figure (1)

## Experiment theory:

**The Wheatstone bridge:**

**- is an electrical circuit used to measure an unknown electrical resistance with high accuracy.**

**Q/ What principle does the Wheatstone bridge rely on?**

**- It relies on the principle of currents balance.**

**Q/ What is the importance of the galvanometer in the Wheatstone bridge experiment?**

**-To determine the state of equilibrium.**

**Q/ What is the similarity between Ohm's Law experiment and the Whetstone bridge experiment?**

- **Finding the value of resistance**

**When an electrical circuit is connected as in Figure (1) and a current passes through the circuit, the current will be divided into two parts. $I_1$ passes through resistors 3R and R4 and $I_2$ passes through resistors R1 and R2.**

**If the potential of point B Is equal to the potential of point D, which is what we call the state of equilibrium, then the potential difference of two points AB is equal to the potential difference of two points AD and the potential difference of two points CB is equal to the potential difference of two points CD.**

$$V_{AB} = V_{AD} \quad \cdots\cdots\cdots (1)$$

$$V_{CB} = V_{CD} \quad \cdots\cdots\cdots (2)$$

**Therefore, we can compensate for the resistances and currents, and this is:**

$$R_3 \ I_1 = R_2 \ I_2 \quad \cdots\cdots\cdots (3)$$

$$R_x \ I_1 = R_1 \ I_2 \quad \cdots\cdots\cdots (4)$$

**By dividing the two equations, we find that:**

$$R_x = R_3 * R_1/R_2 \quad \cdots\cdots\cdots (5)$$

**If R1 and R2 are resistors from the same wire, their resistance is equal:**

$$R1 = \rho 1 * L1/A1 \quad \cdots\cdots (6)$$

$$R2 = \rho 2 * L2/A2 \quad \cdots\cdots\cdots (7)$$

**Since, as we mentioned, they are from the same wire, they have the same specific resistance p and have the same cross-sectional area A, by dividing (6) by (7)**

**Equation becomes as follows**

$$R_x = R * L1/L2 \quad \cdots\cdots\cdots \quad (8)$$

$$R1/R2 = R3/R4$$

| R | L1 | L2=L- L1 | Rx=R*L1/L2 |
|---|---|---|---|
| 50 | 91 | | |
| 100 | 87 | | |
| 150 | 84 | | |
| 200 | 82 | | |
| 250 | 80 | | |

**Q1/ Find The Value of The resistance R1= ? Knowing That The resistance . R2=20 . R3=15 . R4=60**

**Q2/ Find The Value of The resistance R4= ? Knowing That The resistance . R1=200 . R2=300 . R3=400**