AIM

To find resistance of a given wire using metre bridge.

APPARATUS

A metre bridge (slide wire bridge), a Leclanche cell (Battery eliminator), a galvanometer, a resistance box, a jockey, a one way key, a resistance wire, a metre scale, connecting wires and a piece of sand paper.

A SHORT DESCRIPTION OF METRE BRIDGE

(a) Description

Slide wire bridge or metre bridge is the practical form of Wheatstone bridge. Usually, P and Q are called ratio arms of fixed resistance, R is an adjustable or variable resistance of known value. S is replaced by an unknown resistance X in Fig. 1 and balance point is obtained at B on the metre bridge wire.

Under balanced condition of bridge (no current flows in galvanometer arm)

$$\frac{P}{Q} = \frac{R}{S}$$

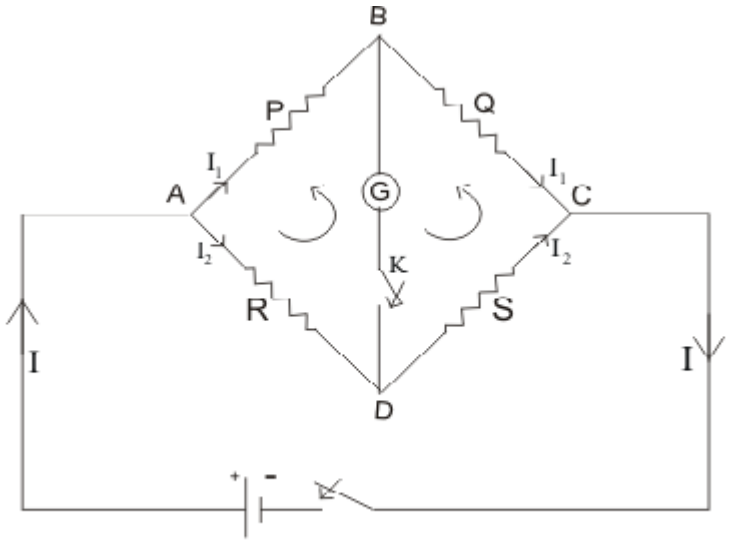

Figure 1. Wheatstone's Bridge in balanced condition

Since the bridge uses 1 metre long wire, it is called metre bridge. Since a jockey is slided over the wire, it is also called a slide wire bridge.

(b) Theory

As the meter bridge wire AC has uniform material density and area of cross-section, its resistance is proportional to its length. Hence, AB and BC are the ratio arms and their resistance correspond to resistance P and Q, and length corresponds to l and (100-l) respectively.

So, resistance of AB arm of length= l cm $P = \rho \frac{l}{A}$

And resistance of BC arm of length (100-l) cm $Q = \rho \frac{100 - l}{A}$

Where ρ is specific resistance and A is cross sectional area of meter bridge wire

R is known resistance and S=X unknown resistance. Now the equation reduces to

$$\frac{l}{100 - l} = \frac{R}{X}$$

Therefore, $$X = R\frac{100 - l}{l}$$

This is the working formula for unknown resistance, where R is known resistance placed in the left gap and unknown resistance X in the right gap of metre bridge. l cm is the length of metre bridge wire form zero end upto balance point.

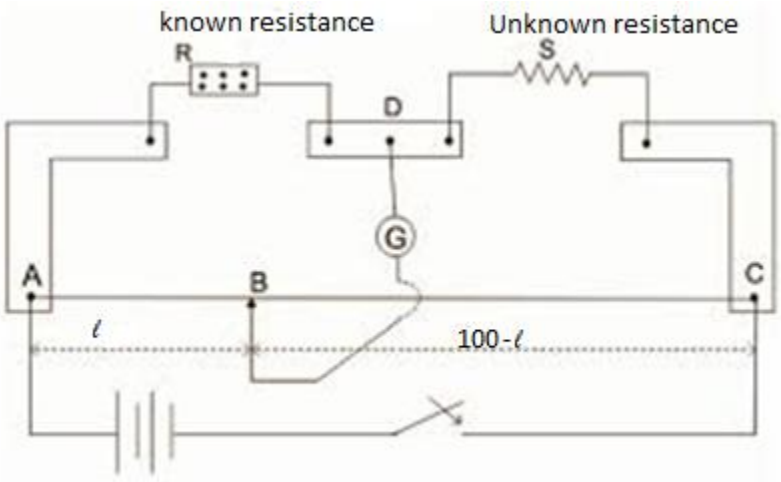

Fig. 2 Circuit diagram – Meter Bridge

PROCEDURE (*Stepwise*)

For Resistance

1. Draw the circuit diagram as shown in Fig. 2 and arrange the apparatus according to the arrangement diagram.
2. Connect the resistance wire whose resistance is to be determined in the right gap between C and D. Take care that no part of the wire forms a loop.

3. Connect resistance box of low range in the left hand gap between A and D.
4. Make all the other connections as shown in the circuit diagram.
5. Take out some resistance (say 2 ohm) from the resistance box, plug the key K.
6. Touch the jockey gently first at left end and then at right end of the bridge wire.
7. Note the deflections in the galvanometer. If the galvanometer shows deflections in opposite directions, the connections are correct. If the deflection is one side only, then there is some fault in the circuit. Check or seek help of your teacher and rectify the fault.
8. Move **(slide)** the jockey gently along the wire from left to right till galvanometer gives no deflection. The point where the jockey is touching the wire in null point B.
9. Choose an appropriate value of R from the resistance box such that there is no deflection in the galvanometer when the jockey is nearly in the middle of the wire (i.e. between 45 cm to 55 cm).Note position of point D to know length AB= *l*.
10. Take at least four sets of observations in the same way by changing the value of R in the steps.
11. Record your observations as given in table.

OBSERVATIONS

Table for length (*l*) and unknown resistance (X)

Serial No. of Obs. **(1)**	**Resistance from the resistance box R (ohm)** **(2)**	**Length AB= *l* (cm)** **(3)**	**Length BC= (100 - *l*) (cm)** **(4)**	**Unknown resistance** $X = R\frac{(100 - l)}{l}$ **(ohm)** **(5)**
1. 2. 3. 4.				

RESULT

The value of unknown resistance X= ……ohm.

PRECAUTIONS (*to be taken*)

1. The connections should be neat, clean and tight.
2. All the plugs in the resistance box should be tight.
3. Move the jockey gently over the bridge wire and do not rub it.
4. The plug in the key K should be inserted only when the observations are to be taken.
5. Null point should be brought between 45cm to 55cm.
6. Set square should be used to note null point to avoid error of parallax.
7. At one place, diameter of wire should be measured in two mutually perpendicular directions.
8. The wire should not make a loop.

SOURCES OF ERROR

1. The instrument screws may be loose.
2. The plugs may not be clean.
3. The wire may not have uniform thickness.
4. The screw guage may have faults like back lash error and wrong pitch.