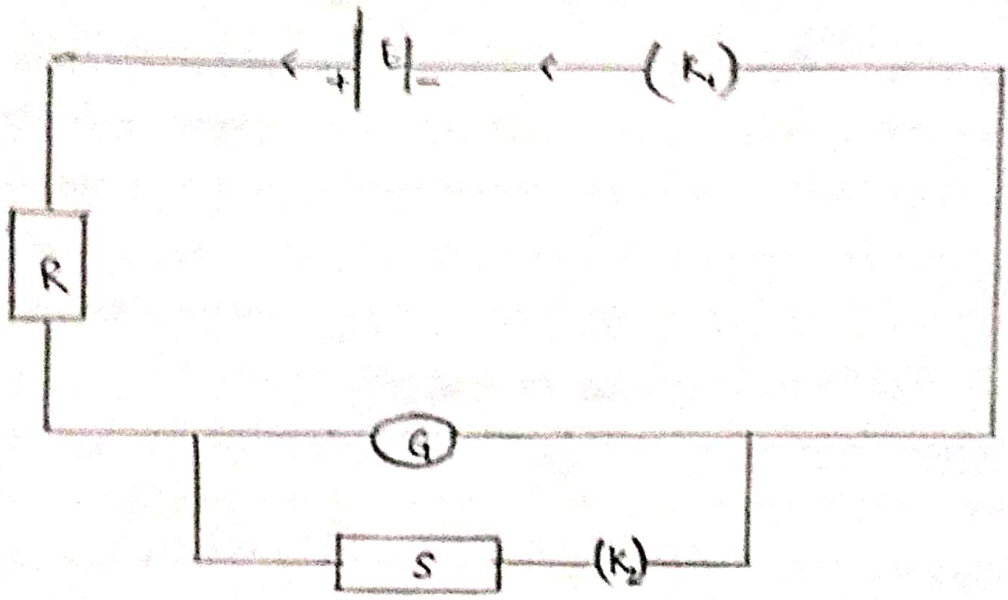

i) For Half Deflection Method

EXPERIMENT-10

- AIM: To determine resistance of a galvanometer by half deflection method and to find its figure of merit.

- REQUIREMENTS: A galvanometer, a voltmeter, a battery, two resistance boxes, rheostat of high resistance, one way key, screw gauge and connecting wires.

- THEORY: A galvanometer is a device used to detect small electric current in a circuit. It has a coil pivoted in a radial magnetic field. When electric current is passed through the coil, it gets deflected. Its deflection is noted by attaching a pointer to the coil. The deflection is proportional to the electric current passed. A galvanometer has a moderate resistance (100 $\sqrt{\Omega}$) and have a very small current carrying capacity (1mA).

The resistance of a galvanometer can be found by using half deflection method. The circuit diagram for this method is as shown. The key K is inserted and deflection θ is determined with a suitable value of R. The E is the emf of the cell and and I the current in the circuit, then

$$I = K\theta$$

Total circuit resistance $= R + G$

$$\therefore \quad I = \frac{E}{R+G} \qquad \ldots (1)$$

$$\therefore \quad \frac{E}{R+G} = K\theta$$

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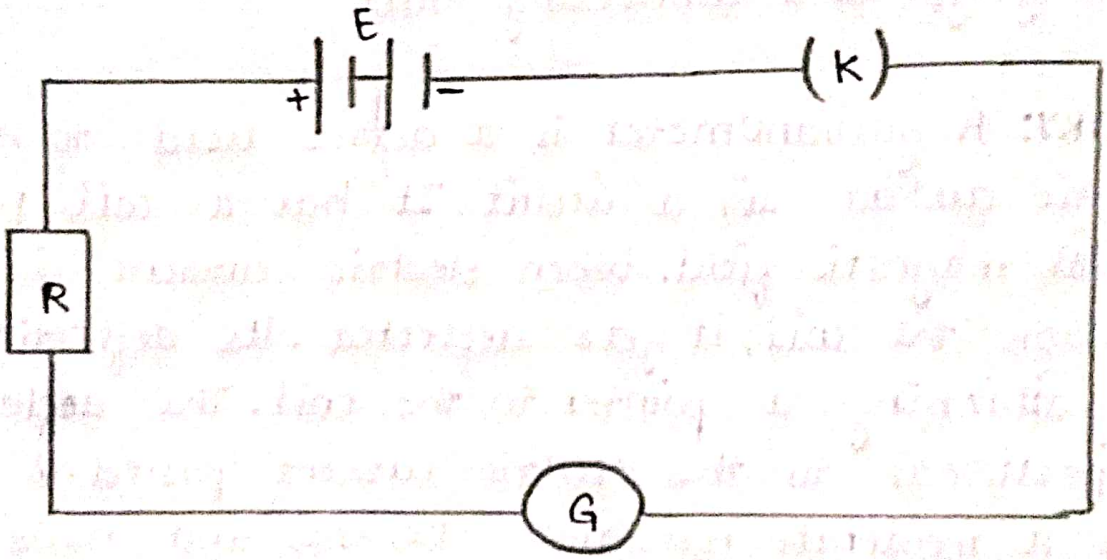

(ii) for figure of Merit

Page No.
Date : / /20

Now, insert the key K_2 and adjust the shunt resistance S, so that the deflection becomes $\frac{\theta}{2}$.

Now, total resistance of the circuit

$$= R + \frac{GS}{G+S}$$

The current I, now in the circuit

$$I = \frac{E}{R + \frac{GS}{G+S}}$$

Current throughout the galvanometer I_g is

$$I_g = I \cdot \frac{S}{G+S} = \frac{E}{R + \frac{GS}{G+S}} \cdot \frac{S}{G+S}$$

$$I_g = \frac{ES}{R(G+S)+GS}$$. This current produces a deflection $\frac{\theta}{2}$.

$$\therefore \frac{ES}{R(G+S)+GS} = k\frac{\theta}{2} \quad \ldots(2)$$

From (1) and (2) we get

$$\frac{E}{R+G} = 2\frac{ES}{R(G+S)+GS}$$

or $R(G+S)+GS = 2S(R+G)$

or $RG+RS+GS = 2RS+2SG$

or $(R-S)G = RS$

or $G = \frac{RS}{R-S}$, knowing R, S, G can be determined.

If $R \gg S$, then $G = S$

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Page No.
Date : / /20

figure Of Merit: The figure of merit K of a galvanometer is defined as the current required for producing a deflection of 1 division. It is measured in amp/division.

The circuit diagram for the figure of merit is as shown When a high resistance R is taken out from the resistance box, a current I flows in the circuit and it produces a deflection θ.

$$\therefore \quad I = \frac{E}{R+G} = K\theta, \text{ where } K \text{ is the figure of merit}$$

$$\therefore \quad K = \frac{E}{(R+G)\theta} \qquad \ldots(3)$$

By varying R, and noting corresponding values of θ, we can find a set of values of figure of merit are determine The mean of these values gives the figure of merit.

The maximum current that can be passed through the galvanometer is $I_g = NK$, where N is the total number of divisions of either of zero of the galvanometer scale.

OBSERVATIONS: TABLE I (Mean value of G = 105.99 ohm)

i) FOR RESISTANCE OF GALVANOMETER BY HALF DEFLECTION METHOD

S. No.	Resistance R (ohm)	Deflection in galvanometer (θ)	Shunt resistance S (ohm)	Half deflection (θ/2)	Galvanometer $G = \frac{RS}{R-S}$ (ohm)
1.	5000	26	100	13	102.04
2.	7000	20	110	10	111.75
3.	6000	24	105	12	106.87
4.	8000	19	102	9.5	103.31

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Page No
Date : / /20

TABLE 2

ii) FOR FIGURE OF MERIT

S.NO	Number of cells	emf of the cells E (Volts)	Resistance from R.B (ohm)	Deflection θ (div.)	Figure of Merit $K = \frac{E}{(R+G)\theta}$ A/div
1.	One	3.10	5000	30	2.02
2.	One	3.15	7000	20	2.21
3.	TWO	5.00	9000	30	1.83
4.	TWO	4.90	10000	25	1.93

Mean value of K = 1.99 Amp/div

- RESULT:

i) Resistance of galvanometer is found to be 105.99 Ohm

ii) Figure of merit of galvanometer is 1.99 amp/div.

- PRECAUTIONS:

i) All the connections should be neat, clean and tight.

ii) Ensure that the plugs of resistance box are tight.

iii) Initially a high resistance from the resistance box should be introduced or else a small resistance can damage the galvanometer.

- SOURCES OF ERROR:

i) The screws of the instruments may be loose.

ii) The plugs of galvanometer may not be tight.

iii) The galvanometer divisions may not be of same size

iv) The emf of the battery may not be constant.

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