EXPERIMENT No :- DATE :-

FOUR PROBE METHOD-I

AIM: Determination of resistivity of a semiconductor (Ge)

APPARATUS: Four Probe setup, Oven, Ge Crystal and thermometer.

DIAGRAM:

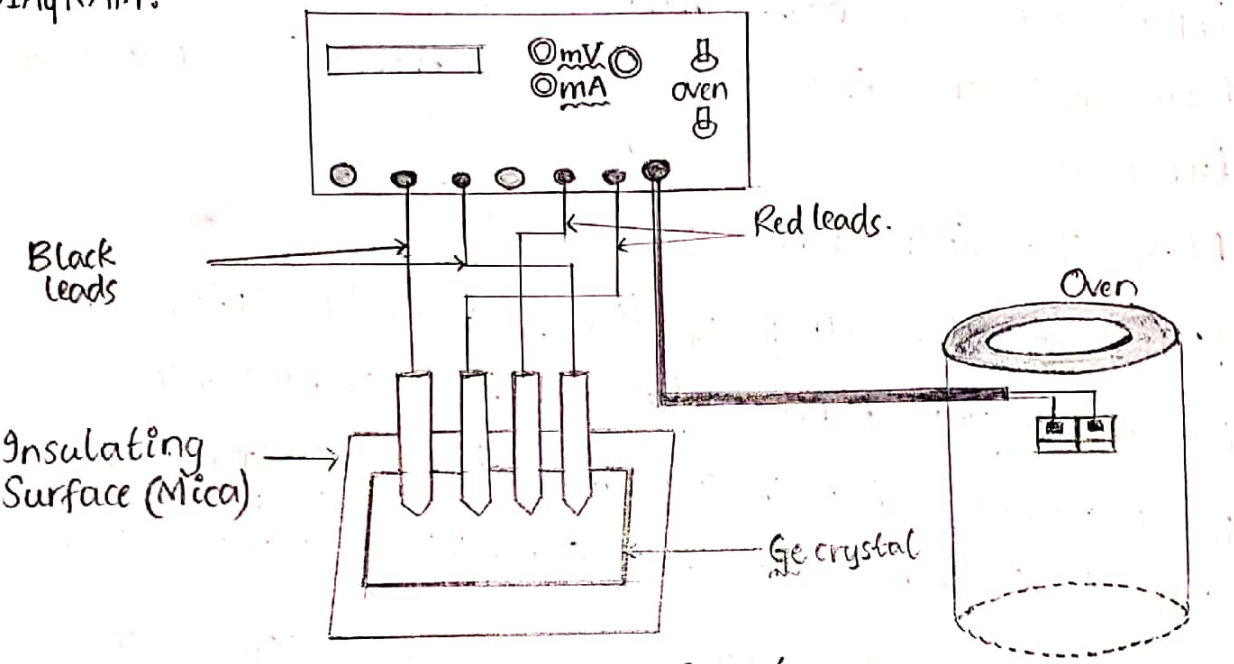

Figure 1:- EXPERIMENTAL SETUP / DIAGRAM

FORMULA:

$$\rho = \frac{V}{I} \times \frac{2\pi S}{G_7\left(\frac{W}{S}\right)}$$

Resistivity units : Ωcm

Where, V = Potential difference between probes 2 and 3

I = Current passed through the crystal

$S = S_1 = S_2 = S_3$ = Probe spacing

$G_7\left(\frac{W}{S}\right)$ = Correction factor.

PROCEDURE:

Resistivity of Ge Crystal.

1) Ensure that the Ge Crystal is placed on the base plate of the four probe arrangement and the four probes rest in the middle of the Ge crystal.

2) Connect the outer pair of probes to the constant current terminals and the inner pair of probes to the voltage terminals.

3) Place the four probe arrangement in the oven.

4) Switch on the supply of the four probe setup and put the digital panel meter in the current measuring mode with the help of selector switch. Adjust the current to 2 mA. Now put the digital panel meter in the voltage measuring mode and note down the voltage.

5) Change the current in intervals of 1 mA starting from 2mA up to 10 mA and note down the corresponding voltages in the given table.

6) Using the given formula, the average resistivity of the Ge crystal at room temperature is to be calculated.

OBSERVATIONS:

RESISTIVITY OF Ge CRYSTAL

Room temperature (RT) =

Probe spacing $S = 0.2$ cm, Correction factor for the given Crystal $G_7\left(\frac{W}{S}\right) = 5.89$

S.NO	CURRENT (mA)	VOLTAGE (mV)	RESISTIVITY (Ω cm)	AVERAGE RESISTIVITY (Ω cm)
1	2	102	10.86	10.989
2	3	153	10.863	
3	4	205	10.916	
4	5	258	10.991	
5	6	310	11.005	
6	7	362	11.015	
7	8	416	11.076	
8	9	469	11.099	
9	10	520	11.076	

CALCULATIONS:

Room Temperature (RT) = 30°C, Probe Spacing $S = 0.2$ cm

Correction factor for the given crystal $G_7\left(\frac{W}{S}\right) = 5.89$

$$\rho = \frac{V}{I} \times \frac{2\pi S}{G_7\left(\frac{W}{S}\right)}$$

$$\Rightarrow \frac{2\pi S}{G_7\left(\frac{W}{S}\right)} = \frac{2\pi \times 0.2}{5.89} = 0.213$$

1.) $\therefore \rho = \frac{102}{2} \times 0.213 = 10.86\ \Omega$ cm

2.) $\rho = \frac{153}{3} \times 0.213 = 10.863\ \Omega$ cm

3) $\rho = \frac{205}{4} \times 0.213 = 10.916\ \Omega\,cm$

PRECAUTIONS:

1) Do not apply pressure on the electrical contacts to the Ge crystal as it is very brittle.
2) Ensure that the oven is OFF.

RESULT:

Resistivity of the Given Ge crystal at room temperature is found to be 10.989 Ω cm.