

EXPERIMENT NUMBER- 2.4

Student Name:

UID:

Branch: Computer science

Section/Group:

Semester: 01

Date of Performance:

AIM OF THE EXPERIMENT– To determine the resistivity of Semiconductor by Four Probe Method.

APPARATUS- The experimental set up consists of probe arrangement, oven 0-200°C, constant current generator, oven power supply and digital panel meter (measuring voltage and current).

OBSERVATION-

- (i) Distance between Probes (s) = **0.2cm**
- (ii) Thickness of the crystal chip (W) = **0.05cm**
- (iii) Current (I) = **3mA** (constant)
- (iv) voltage Range (V) = **100mV**

From the Standard table $f(W/s) = 5.89$

S.NO.	Temp. in °C	Temp. in K	Voltage(V) in Volts	$\rho(\text{ohm cm})$
1.	30	303	84.65	6.0292
2.	40	313	79.94	5.6807
3.	50	323	75.75	5.3843

1

$$\text{Mean of Resistivity } (\rho) = \frac{6.0292+5.6807+5.3843}{3} \text{ ohm cm} = 5.698 \text{ ohm cm}$$

CALCULATIONS-

1.

Case 1^o
Temp $\rightarrow 30^{\circ}\text{C}$
 $\rightarrow 303\text{K}$
Voltage $\rightarrow 84.65\text{mV}$

Now, we will find f_0

$$f_0 \Rightarrow \frac{V}{I} \times 2\pi S$$

$$f_0 \Rightarrow \frac{84.65}{3} \times 2 \times 3.14 \times 0.2$$

$$f_0 \Rightarrow 28.21 \times 2 \times 3.14 \times 0.2$$

$$f_0 \Rightarrow 28.41 \times 1.256$$

$$f_0 \Rightarrow 35.5125$$

Now, resistivity $\rho = \frac{f_0}{f(\omega/s)}$

$$= \frac{35.5125}{5.89}$$

$$\Rightarrow 6.0292\text{ cm}$$

CASE- 1

2.

Case 2^o
Temp $\rightarrow 40^{\circ}\text{C}$
 $\rightarrow 313\text{K}$
Voltage $\rightarrow 79.94\text{mV}$

Now, find f_0

As we know $f_0 = \frac{V}{I} \times 2\pi S$

$$f_0 = \frac{79.94}{3} \times 2 \times 3.14 \times 0.2$$

$$f_0 = 26.64 \times 0.4 \times 3.14$$

$$f_0 = 26.64 \times 1.256$$

$$f_0 = 33.4598$$

Now, find resistivity

$$\rho = \frac{f_0}{f(\omega/s)}$$

$$= \frac{33.4598}{5.89}$$

$$\Rightarrow 5.6807\text{ cm}$$

CASE- 2

2

3.

Case 3^o
Temp $\rightarrow 50^{\circ}\text{C}$
 $\rightarrow 323\text{K}$

Voltage $\rightarrow 75.75\text{ mV}$

Now, find ρ_0

$$\rho_0 = \frac{V}{I} \times 2\pi S$$

$$\rho_0 = \frac{75.75}{3} \times 2 \times 3.14 \times 0.2$$

$$\rho_0 = 25.25 \times 1.256$$

$$\rho_0 = 31.7140$$

Now, finding resistivity

$$\rho = \frac{\rho_0}{f(\omega/s)}$$

$$= \frac{31.7140}{5.89}$$

$$\Rightarrow 5.3843\text{ cm}$$

CASE- 3

SOURCES OF ERROR-

- The resistivity of the material should be uniform in the area of measurement.
- The surface on which the probes rest should be flat with no surface leakage.
- The diameter of the contact between the metallic probes and the semiconductor crystal chip should be small compared to the distance between the probes.

RESULTS AND DISCUSSION-

Resistivity of semiconductor = **5.6980 ohm cm.**

The resistivity decreases exponentially with the increase in T. That is as at low temperatures resistivity is more and at high temperatures the resistivity is less.

LEARNING OUTCOMES

- It will provide the modest experience that allows students to develop and improve their experimental skills and develop ability to analyzedata.
- Ability to demonstrate the practical skill on measurements and instrumentation techniques of some Physics experiments. Students will develop the ability to use appropriate physical concepts to obtain quantitative solutions to problems inphysics.
- Students will demonstrate basic experimental skills by setting up laboratory equipment safely and efficiently, plan and carry out experimental procedures, and report verbally and in written language the results of theexperiment.
- Students will develop skills by the practice of setting up and conducting anexperimentwithdueregardstominimizing measurement error.

EVALUATION COLUMN (To be filled by concerned faculty only)

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Worksheet completion including writing learning objectives/Outcomes. (To be submitted at the end of the day)	10	
2.	Post Lab Quiz Result.	5	
3.	Student Engagement in Simulation/Demonstration/Performance and Controls/Pre-Lab Questions.	5	
4.	Total Marks	20	
5.	Teacher's Signature (with date)		