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Vision & Mission of Delhi Technological University

Vision

"To be a world class university through education, innovation and research for the service of humanity"

Mission

1. To establish centers of excellence in emerging areas of science, engineering, technology, management and allied areas.

2. To foster an ecosystem for incubation, product development, transfer of technology and entrepreneurship.

3. To create environment of collaboration, experimentation, imagination and creativity.

4. To develop human potential with analytical abilities, ethics and integrity.

5. To provide environment friendly, reasonable and sustainable solutions for local & global needs.

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Vision & Mission

Vision

Consolidated teaching and learning process covering all aspects of pure and applied physics that promotes research and development leading to creation of new knowledge, inventions and discoveries fostering institute industry linkages and entrepreneurial culture for betterment of all its stakeholders and society at large.

Mission

M1 → To establish global and industry standards of excellence by generating new knowledge in all the endeavour concerned to teaching

M2 → To develop close linkages with students industry to undertake collaborative projects so as to teaching and enabling ground engineers.

M3 → To help our students in developing human potentials, intellectual interests, creative abilities and be life long learners to meet the challenges of the national and global environment

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and be true professional leaders

M4:- To stand up to the needs and expectations of our society by equipping and training our students to be a good citizens, aware of their commitments and responsibilities, to make the world a better place to live.

M5:- To be a world class centre for education, research and innovation in the various upcoming fields of applied physics

M6:- To focus on the development of cutting-edge technologies and to foster an environment of seamlessness between academia and industry

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EXPERIMENT NO:-1

1. Aim: To study Hall effect and to determine Hall voltage V_H, Hall coefficient R_H and hence find the density of charge carriers in a semiconductor at room temperature by Hall effect measurement.

2. Apparatus:- Two solenoids, constant current supply, four probe, Digital gauss meter, Hall effect apparatus (which consists of constant current generator (CCG), digital millivoltmeter and Hall probe.

3. Formula Used:

$$V_H = \frac{IB}{net} \rightarrow (i).$$

$$V_H = R_H\left(\frac{IB}{t}\right) \rightarrow (ii)$$

V_H = Hall voltage
I = Hall Current
B = Magnetic field
n = number density of electrons
e = charge of electrons
t = thickness of slab
R_H = Hall coefficient.

Carrier Concentration = $n = \frac{B}{\text{slope} \times e \times t}$

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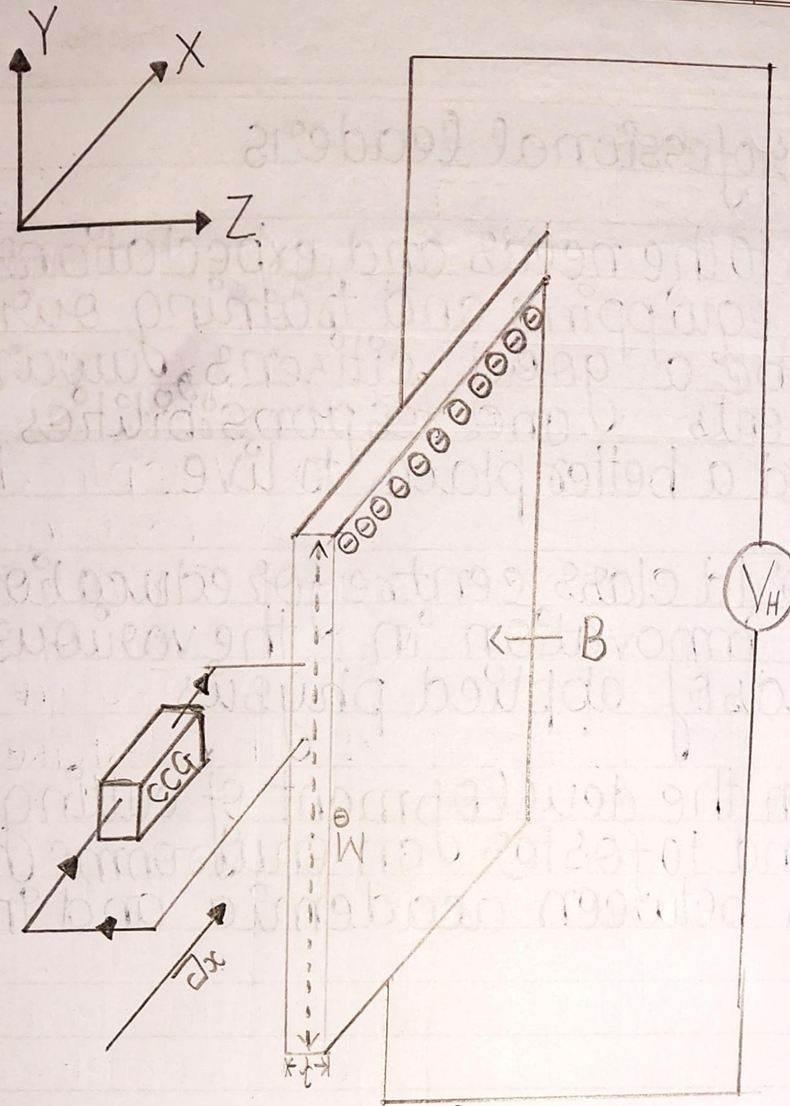

(fig i)

Representation of Hall effect in a Conductor

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4. Theory

If a current carrying conductor placed in a perpendicular magnetic field, a potential difference will generate in the conductor which is perpendicular to both magnetic field and current. This phenomenon is called Hall effect.

Hall effect is an important tool to characterise the materials especially semiconductors. It directly determines the strength and density of charge carriers in the given sample.
Consider a rectangular conductor of thickness 't' kept in X-Y plane. An electric field is applied in X-direction using constant current generators so that current 'I' flows through the sample. W is the width of sample and t is the thickness. If the magnetic field is applied along the negative Z axis, the Lorentz force moves the charge carries toward the y-direction. This results in accumulation of charge carriers at the top edge of the sample. This set up a transverse electric field E_y in the sample. This develops a potential difference along Z axis known as Hall voltage V_H

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Observation Table.

Material used = Germanium

1.) Magnetic field in between the solenoids for different current through solenoid

Trial No.	Current through solenoid (A)	Magnetic field Generated (T)
1	1	0.1482
2	2	0.2964
3	3	0.4447

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5. Procedure.

To measure the magnetic field generated in solenoid

- Select B Vs i from the procedure combo-box
- Click insert probe button
- Placing the probe in between the solenoid
- Using current slides, varying the current through the solenoid and note magnetic field from Gauss Hall effect apparatus
- Select Hall effect setup
- Click Insert Hall probe button.
- Placing the probe in between the solenoid.
- Set "current slides" value to minimum.
- Set material from "select material" combo-box
- Vary the Hall effect current using slider Hall current
- Note down the corresponding Hall voltage by clicking "show voltage" button.
- Then calculate Hall coefficient and carrier concentration of that material
- Repeat the experiment with different magnetic fields

6. Results:-> Hall Coefficient of Material = 0.019403 m^3/C

Carrier concentration of the material = $3.218 \times 10^{20} m^{-3}$

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2) Calculation of Hall Voltage & Hall coefficient

	S.No	Magnetic Field (in T)	Thickness t in mm	Hall Current (in mA)	Hall Voltage V_H (in mV)	R_H
	1	0.1482	0.1	1	28.756	0.019403
	2	0.1482	0.1	1.5	43.133	0.019403
	3	0.1482	0.1	2	57.511	0.019403
1	4	0.1482	0.1	2.5	71.889	0.019403
	5	0.1482	0.1	3	86.267	0.019403
	6	0.1482	0.1	3.5	100.645	0.019403
	7	0.1482	0.1	4	115.023	0.019403
	8	0.1482	0.1	4.5	129.40	0.019403
	1	0.2964	0.1	1	57.511	0.019403
	2	0.2964	0.1	1.5	86.267	0.019403
	3	0.2964	0.1	2	115.023	0.019403
	4	0.2964	0.1	2.5	143.778	0.019403
2	5	0.2964	0.1	3	172.534	0.019403
	6	0.2964	0.1	3.5	201.29	0.019403
	7	0.2964	0.1	4	230.045	0.019403
	8	0.2964	0.1	4.5	258.801	0.019403
	1	0.4447	0.1	1	86.267	0.019403
	2	0.4447	0.1	1.5	129.400	0.019403
3	3	0.4447	0.1	2	172.534	0.019403
	4	0.4447	0.1	2.5	215.667	0.019403
	5	0.4447	0.1	3	258.801	0.019403
	6	0.4447	0.1	3.5	301.934	0.019403
	7	0.4447	0.1	4	345.068	0.019403
	8	0.4447	0.1	4.5	388.201	0.019403

Calculations:

1.) Magnetic field = 0.1482 T

$$\text{Slope} = \frac{129.4 - 28.756}{4.5 - 1} = 28.7554$$

$$\text{Carrier concentration} = \frac{B}{\text{slope} \times e \times t}$$

$$= \frac{0.1482}{28.754 \times 1.602 \times 10^{-19} \times 0.1 \times 10^{-3}}$$

$$= 3.2171 \times 10^{20} \, m^{-3}$$

2.) Magnetic field = 0.2964 T

$$\text{Slope} = \frac{258.801 - 57.511}{4.5 - 1} = 57.511$$

$$\text{Carrier concentration} = \frac{B}{\text{slope} \times e \times t}$$

$$= \frac{0.29641}{57.511 \times 10^{-3} \times 0.1 \times 1.602 \times 10^{-19}}$$

$$= 3.2171 \times 10^{20} \, m^{-3}$$

3.) Magnetic field = 0.4447 T

$$\text{Slope} = \frac{388.201 - 86.267}{4.5 - 1} = 86.267$$

$$\text{Carrier concentration} = \frac{B}{\text{slope} \times e \times t} = \frac{0.4447}{86.267 \times 10^{-3} \times 0.1 \times 1.602 \times 10^{-19}}$$

$$= 3.221 \times 10^{20} \, m^{-3}$$

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Experiment No: 1

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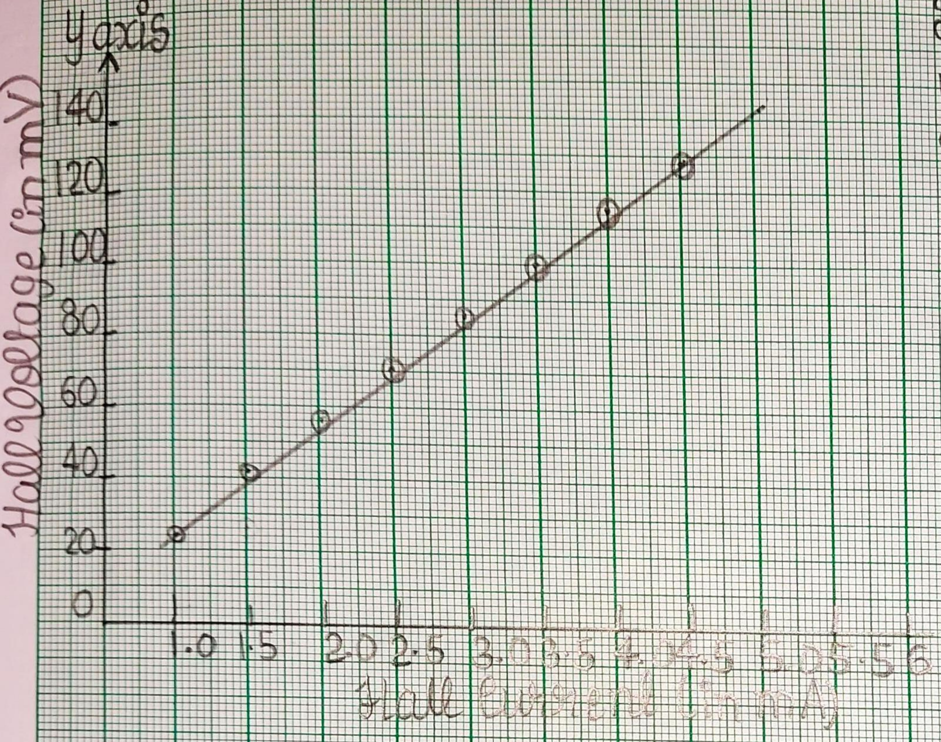
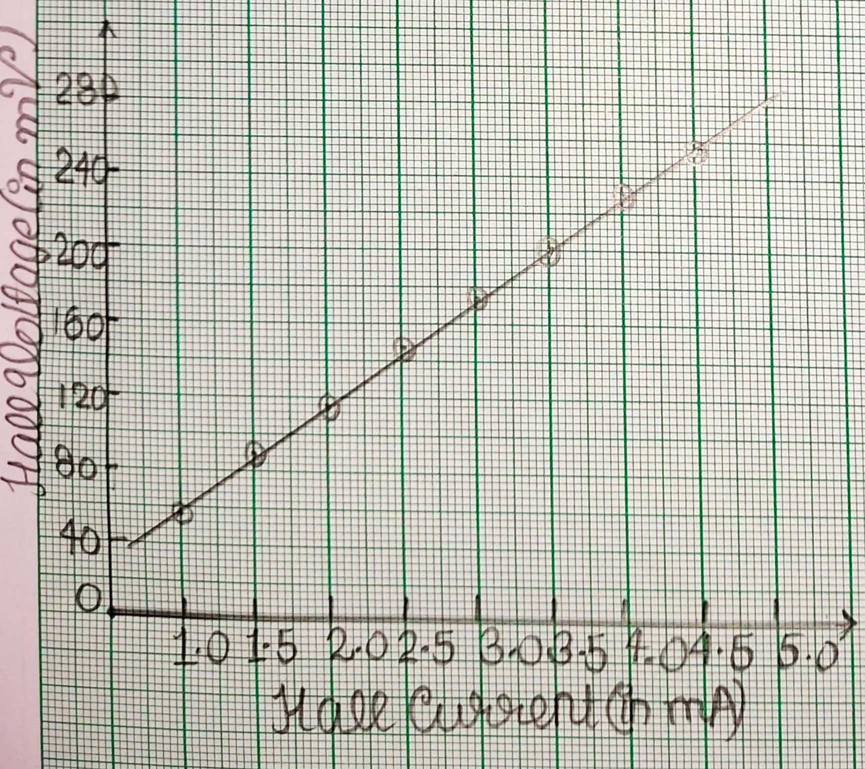


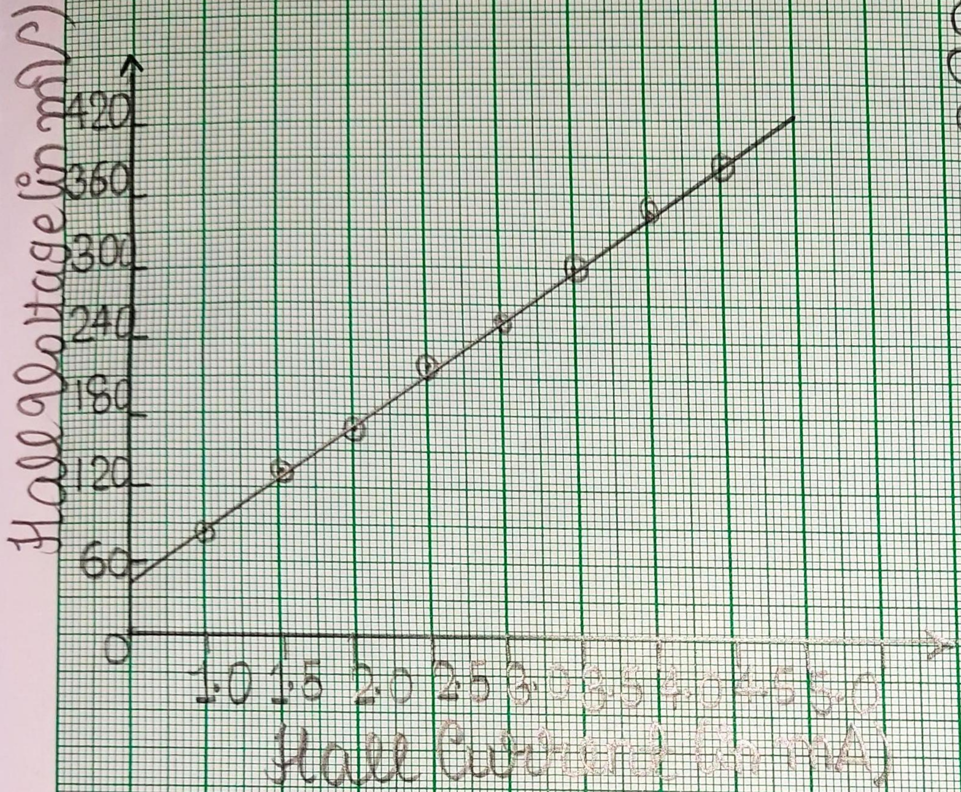
Scale
Y axis
1 unit = 20mV
X axis
1 unit = 0.5mA



Scale
Y axis
1 unit = 40mV
X axis
1 unit = 0.5mV

Experiment No~1

Parth Bohra
2K20/B17/33.



Scale
Y axis
1 unit = 60 mV
X axis
1 unit = 0.5 mA

Average carrier concentration =

$$\left(\frac{3.221 + 3.2171 + 3.2171}{3}\right) \times 10^{20}$$

$$= 3.218 \times 10^{20}$$

Percentage Error in Hall Coefficient

$$= \left|\frac{0.0194 - 0.019403}{0.0194}\right| \times 100$$

$$= 0.015\%$$

Percentage Error in carrier concentration

$$= \left|\frac{3.22165 - 3.218}{3.22165}\right| \times 100$$

$$= 0.111\%$$

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7. Precautions & Sources of Error.

1. Electromagnet power supply should be ~~concerned~~ connected to a 3 pin main socket having good earth connection

2. Switch 'on' and 'off' the power supply at zero current position

3. Adjust the distance between the poles of the magnet nearly 1cm, then only gauss meter shows correct reading

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