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Experiment - 2

Aim :

1) To determine the hall voltage developed across the sample material.
2) To calculate the hall coefficient and the carrier concentration of the sample material.

Apparatus :

Two solenoids, Constant current supply, Four probe, digital gauss meter, Hall effect apparatus (CCG), milli voltmeter and hall probe.
Online Virtual Simulator.

Theory :

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

$$eE = nVB \quad , \quad I = neAV$$

$$\text{Hall voltage, } V_H = Ew = VBw = \frac{IB}{net} = R_H \frac{IB}{t}$$

$$R_H = \frac{V_H t}{IB} = \frac{1}{ne}, \text{ Hall coefficient.}$$

Teacher's Signature:

Magnetic Field v/s Current

S.No.	Current (A)	Magnetic field (B)
1	1	0.1482
2	1.5	0.2223
3	2	0.2964
4	2.5	0.3706
5	3	0.4447
6	3.5	0.5188
7	4	0.5929
8	4.5	0.6670
9	5	0.7411

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Procedure :

→ To measure the magnetic field generated in solenoid:

1) Select Magnetic field V/s current.
2) Place the probe in between the solenoid by clicking the wooden stand.
3) Using current slider, varying the current through solenoid and corresponding magnetic field is to be noted.

→ Hall effect Apparatus:

1) Place the probe in between the solenoid.
2) Set "current slider" value to minimum.
3) Vary the hall current from a selected thickness.
4) Note down the corresponding Hall voltage by clicking 'show voltage' button.
5) Then calculate Hall coefficient and carrier concentration of that material using the equation.

Result :

Hall coefficient of the material, $R_H = 0.0194$

Carrier concentration of material, $n = \frac{1}{eR_H} = 3.22 \times 10^{20}\ m^{-3}$.

Teacher's Signature: _____

Hall Effect

S.No.	Hall current (A)	thickness (mm)	Hall Voltage (mV)	R_H
1	1	0.2	28.756	0.0194
2	1.5	0.2	43.133	0.0194
3	2	0.2	57.511	0.0194
4	2.5	0.2	71.889	0.0194
5	3	0.2	86.267	0.0194
6	3.5	0.2	100.645	0.0194
7	4	0.2	115.023	0.0194
8	4.5	0.2	129.40	0.0194
9	5	0.2	143.778	0.0194

Calculation :

current, $I = 2\ A$

thickness $= 0.2$ mm

$$R_H = \frac{V_H t}{IB} = \frac{28.756 \times 0.2}{2 \times 1.482} = 0.0194$$

$$n = \frac{1}{e R_H} = 3.22165 \times 10^{20}\ m^{-3}$$