Hall Effect

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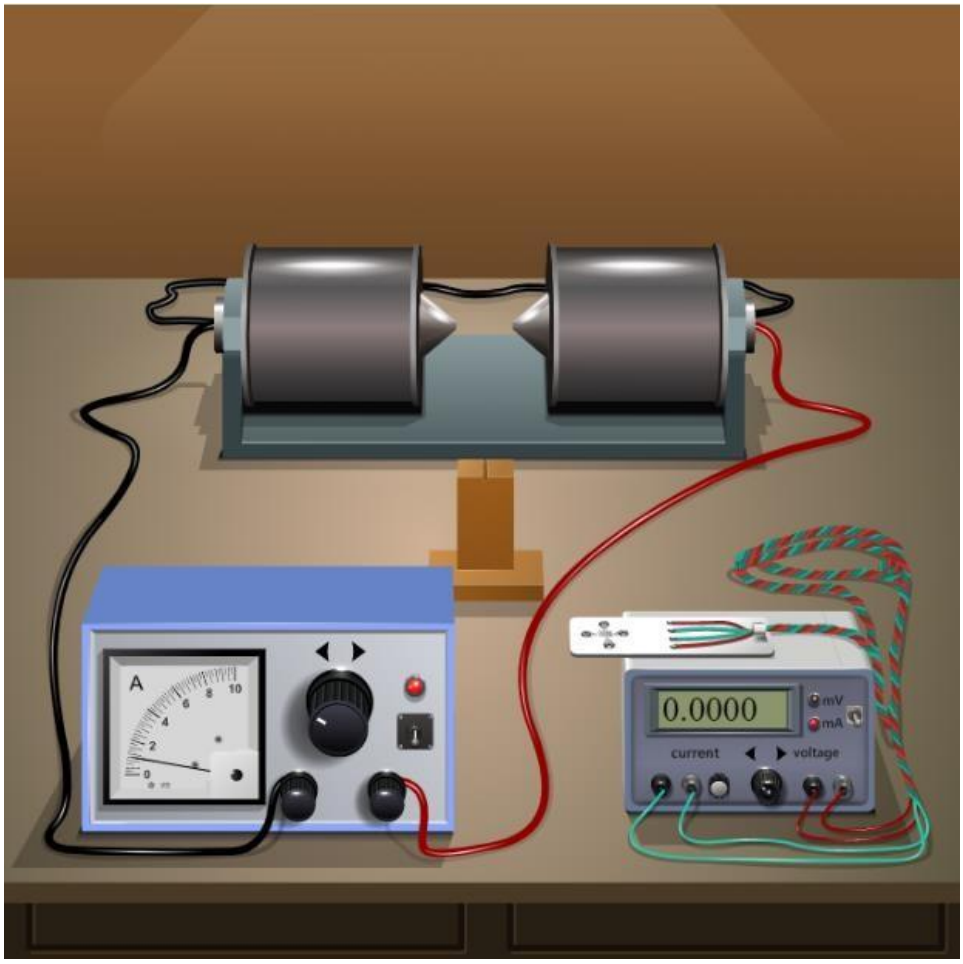
Aim: To calculate the carrier concentration by fixed hall current and plotting a graph of hall voltage and magnetic field.

Apparatus: Two solenoids, Constant current supply, four probe, Digital gauss meter, Hall effect apparatus (which consist of Constant Current Generator (CCG), digital milli voltmeter and Hall probe).

Diagram:



Observation Table:

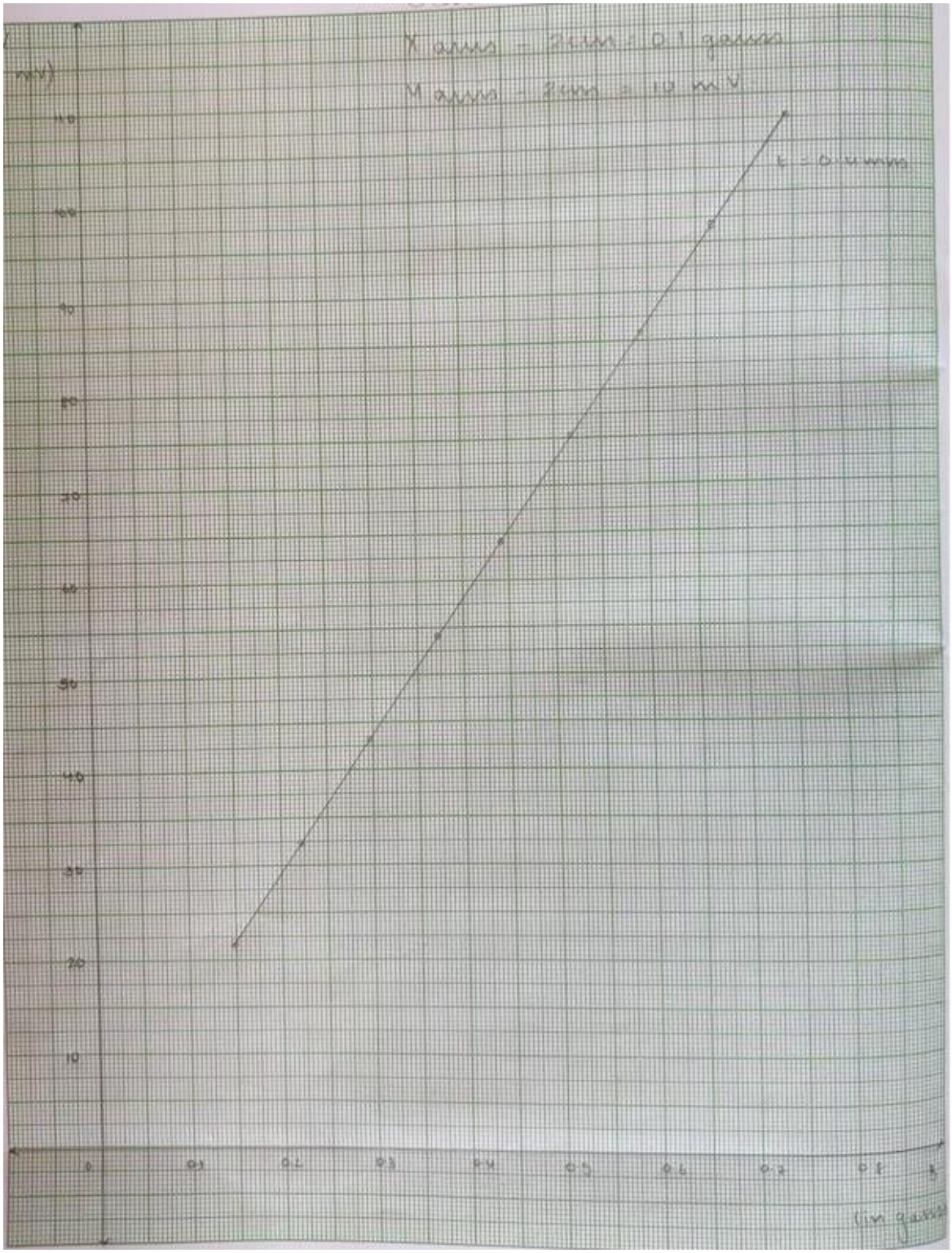
Material: Germanium

Magnetic field B = 0.447 gauss = $44.7 * 10^{-6}$ tesla

Thickness t = 0.4 mm		Thickness t = 0.8 mm	
I_H mA	V_H mV	I_H mA	V_H mV
1	0.1482	1	21.567
1.5	0.2223	1.5	32.350
2	0.2964	2	43.133
2.5	0.3706	2.5	53.917
4	0.4447	4	64.700
3.5	0.5188	3.5	75.484
4	0.5929	4	86.267
4.5	0.6670	4.5	97.050
5	0.7411	5	107.834

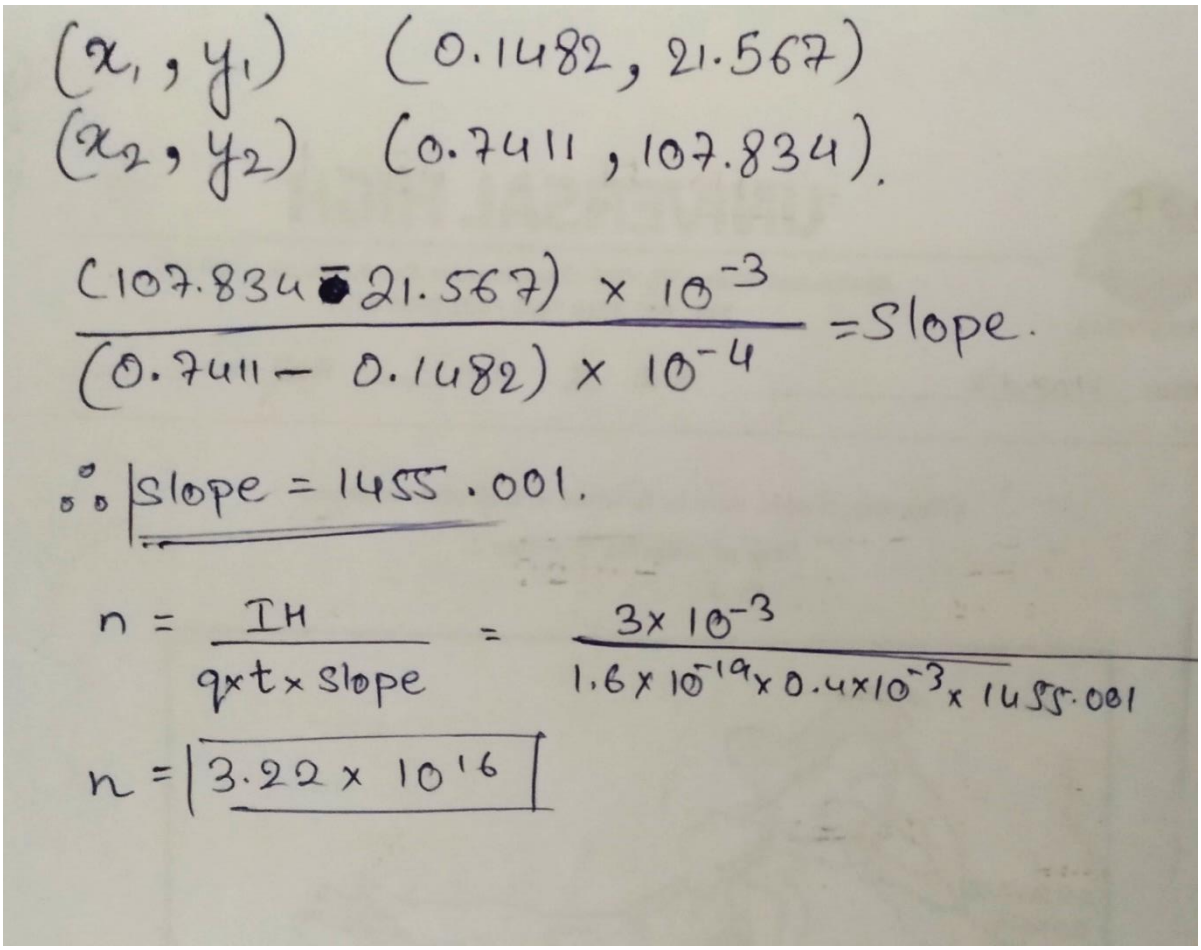
Graph:

Plot Hall voltage (Y-axis) v/s Hall current (X-axis) for different thicknesses



Formula: carrier concentration $n = \frac{B}{q \times t \times slope}$

Calculations:



Home Assignment:

Keep Hall current (I_H) fixed at 3 mA. Vary Magnet current in steps of 0.5 A and note Hall voltage. Plot graph of Hall voltage (Y-axis) v/s Magnetic field* for any one thickness. Calculate carrier concentration using the formula: $n = \frac{I_H}{q \times t \times slope}$

*Find magnetic field for different magnet currents by selecting “Magnetic field v/s Current” from the “Select Procedure” drop-down menu of the simulator.

Observation table for Home Assignment:
Material: Germanium

Hall current: 3 mA

Thickness t = 0.4 OR 0.8 mm		
I ampere (magnet current)	B gauss	V_H mV
1	0.1482	21.567
1.5	0.2223	32.350
2	0.2964	43.133
2.5	0.3706	53.917
4	0.4447	64.700
3.5	0.5188	75.484
4	0.5929	86.267
4.5	0.6670	97.050
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