Name : Hunaid Siamwala S.

Subject : Physics

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* Experiment -7   Hall Effect

Objective:- Measurement of the Hall voltage, charge carrier concentration & hall coefficient.

Equipment needed :- Grauss & Tesla meter NV621, Measurement unit NV622, Constant power supply NV623, Electromagnet, Hall probe. & InAs probe

Procedure:-

1. Take constant current power supply & set the current adjust potentiometer at fully anticlockwise position. Connect electromagnet with constant current power supply such that two coils of electromagnet is in series.

2. Keep the poles of electromagnet at some distance of 10 mm.

3. Connect InAs probe & switch on Grauss & Tesla meter.

4. Adjust zero reading on display by zero adjust potentiometer & keep ready for measurement.

5. Now take measurement unit & set switch position
   • Heater current potentiometer at minimum position.
   • Probe current potentiometer at minimum position.
   • Probe current / Hall voltage switch at probe current position.

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6. Connect Hall probe in given probe socket & switch on the constant current power supply & set some low value of current

7. Switch on measurement unit & increase probe current by probe current potentiometer & fix it at 5mA. Select the Hall Voltage / Probe current display for Hall voltage measurement.

8. There may be some voltage reading even outside the magnetic field. This is due to imperfect arrangement of 4 contact of Hall probe.

9. Now place Hall probe between magnetic poles using stand such the magnetic & electric field should be perpendicular to each other.

Precautions:-

1. In constant current supply, potentiometer fully in anti-clockwise position
2. Heater current & probe current potentiometer at min. position
3. Probe current / Hall voltage switch at probe current position

Result:-

1. Hall Voltage $V_H = $ __5.5__
2. Carrier Concentration $n = $ __1.41×10^{14}__
3. Hall Coefficient $R_H = $ __4.4×10^5__

Conclusion:-

We can say that how V_H, n & R_H are measured and by taking 3 position of the switch.

Observation Table:-

Probe Current (mA)	Magnetic field C (crauss)	Zero field potential (offset voltage)	Hall Voltage for one side with offset Voltage	Hall Voltage for second side with offset Voltage	Hall Voltage for one side without offset Voltage (V^+)	Hall Voltage for one side without offset Voltage (V^-)	Mean Voltage (V_H)
I (mA)	B (crauss)	V_{zero}	V_H^+	V_H^-	$V_H^+ - V_{zero}$	$V_H^- - V_{zero}$	$(V^+ + V^-)/2$
5	1249	54	70	49	16	-5	5.5

* Calculations:-

1. $n = \dfrac{B \times I}{V_H \times t \times e} = \dfrac{1249 \times 5 \times 10^{-3}}{5.5 \times 0.05 \times 10^{-2} \times 1.6 \times 10^{-19}} \implies \underline{1.419 \times 10^{14}}$

2. $R_H = \dfrac{1}{ne} = \dfrac{1}{1.41 \times 10^{4} \times 1.6 \times 10^{-19}}$

   $= 0.443 \times 10^{5}$

   $= \underline{4.4 \times 10^{5}}$