ACADEMIC AFFAIRS

GRADE

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Experiment Number- 01

Student Name: [redacted]
Branch: [redacted]
Semester:
Subject Name Phy [redacted] Lab

UID: [redacted]
Section/Group - 06
Date of Performance: 29/08/2022
Subject Code: 22SPH-141

Aim of the Experiment: To determine the divergence of laser beam.

Apparatus:

S.N	Equipment	Range	Quantity
1.	Power supply / Operating voltage	5MV / 3-12V	1
2.	Diode laser	650nm	1
3.	stand	NA	1

Formula:

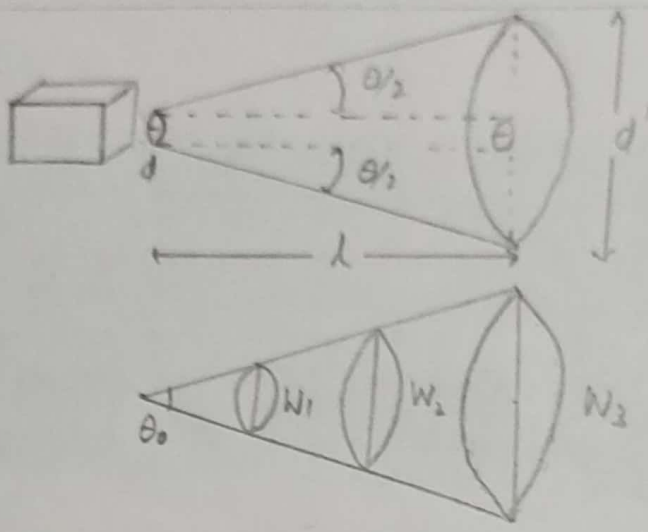
The angle of divergence is given by-

$$\theta = \frac{1}{D} \frac{\sqrt{W_1^2 - 2W_2^2 + W_3^2}}{2}$$

where D is displacement of screen

and W_1, W_2, W_3 are mean diameters

4. Diagram:



→ Divergence of laser beam

5. Observations

(i) The initial distance between laser and screen Z = 50cm

(ii) Displacement of screen D = 25 cm

SN	Distance (CM)	Diameter (CM)		Mean Diameter (CM)	$\theta = \frac{1}{D}\frac{\sqrt{W_1^2+2W_2^2+W_3^2}}{2}$ (milliradian)
		vertical (cm)	Horizontal (cm)		
1.	Z = 50	0.7	0.5	W_1=0.6	
	Z+D = 75	0.9	0.6	W_2=0.75	$\theta = \pm 2\times10^{-3}$
	Z+2D = 100	1.1	0.7	W_3=0.9	

CALCULATIONS:

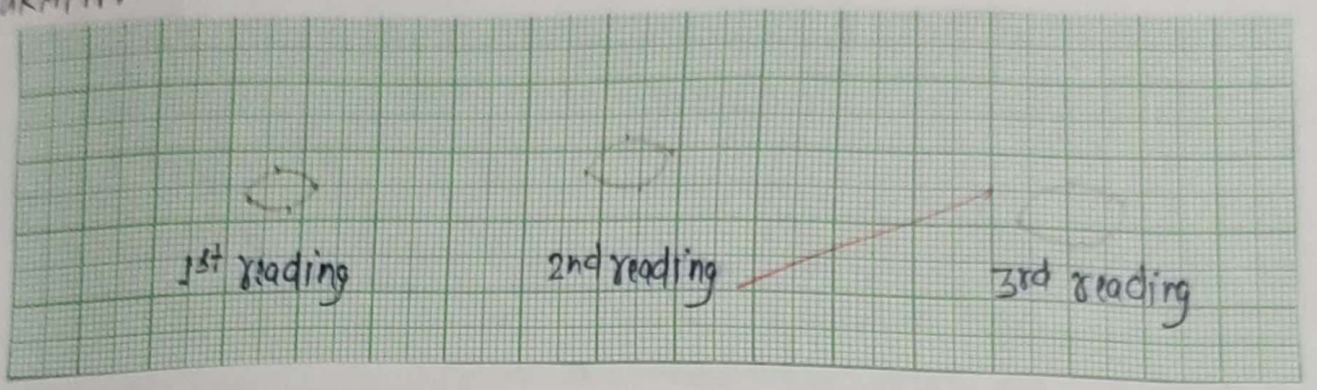
$$\theta = \frac{1}{D}\frac{\sqrt{W_1^2+2W_2^2+W_3^2}}{2}$$

$$\theta = \frac{1}{25}\frac{\sqrt{(0.6)^2-2(0.75)^2+(0.9)^2}}{2}$$

$$\theta = \frac{1}{50}\sqrt{0.36+0.81-1.125} \Rightarrow \theta = \pm 2\times10^{-3} \text{ milliradian}$$

$$\theta = \frac{1}{50}\times\sqrt{0.045}$$

GRAPH:



8. Results

The angle of divergence of diode laser is 4.2×10^{-3} milliradia Science the angle of divergence is very small we conclude that laser is highly directional than ordinary light sources.

9. Sources of Error.

Sources of Errors might be:-

(i) Performing the Experiment in Bright room.
(ii) Not measuring the displacement accurately.

10. Precautions.

(i) Spot size should be measured accurately.

(ii) Laser light should not fall directly to the eyes of the Observer.

rning outcomes (What I have learnt):

- It will provide the modest experience that allows students to develop and improve their experimental skills and develop ability to analyze data.
- 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 in physics.
- 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 the experiment.
- Students will develop skills by the practice if setting up and conducting an experiment with due regards to minimizing measurement error.

valuation Grid:

r. No.	Parameters	Maximum Marks	Marks Obtained
	Student Performnce (Conduct of experiment)	12	10.5
	Viva Voce	10	6
	Submission of Work Sheet (Record)	8	6.5
	Total Marks	30	23
	Teacher's Signature (with date)		8/9

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NAAC GRADE A+ ACCREDITED UNIVERSITY

Experiment Number- 02

Student Name: [redacted]	**UID:** [redacted]
Branch: BE-CSE ([redacted])	**Section/Group** 4/1-A / 06
Semester: 01	**Date of Performance:** 05/09/2022
Subject Name Physics for Engineers Lab	**Subject Code:** [redacted]

1. Aim of the Experiment: To determine the diffraction using laser beam and find the grating element of diffraction grating.

2. Apparatus:

S.N	Equipment	Range	Quantity
1.	Power supply / operating voltage	5M / 3-12 V	1
2.	Diode laser	650 nm	1
3.	Grating	500, 15000 LPI	2
4.	Stand	NA	2

3. Formula:

$$d = n\lambda / \sin\theta$$

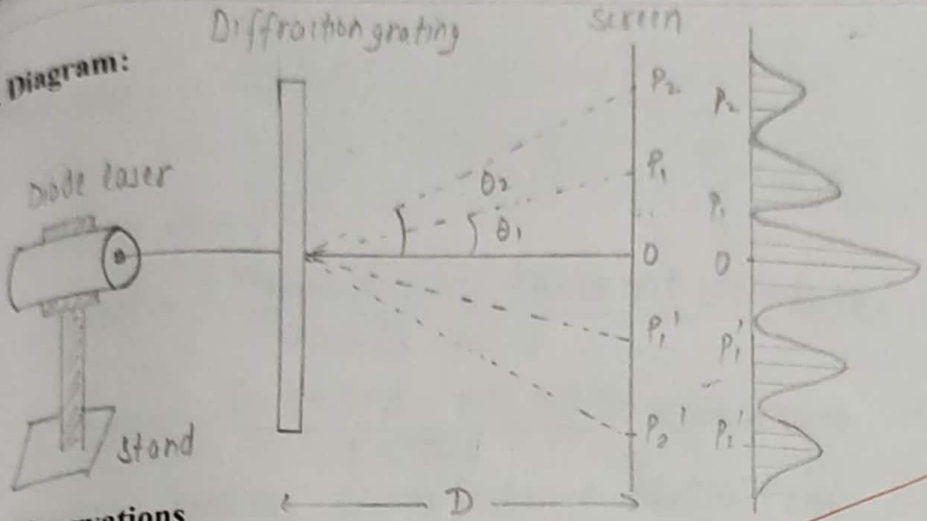
where, θ is the angle of diffraction

d is the grating element

λ is the wavelength of light incident on grating

n is the order of maxima

4. Diagram:



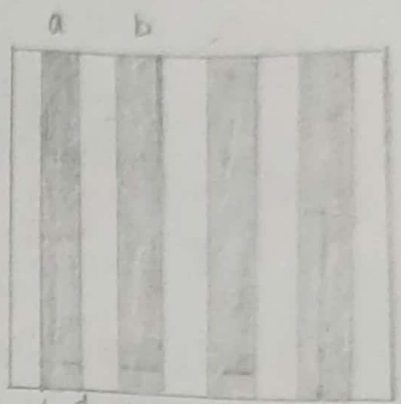


fig 2.2

5. Observations

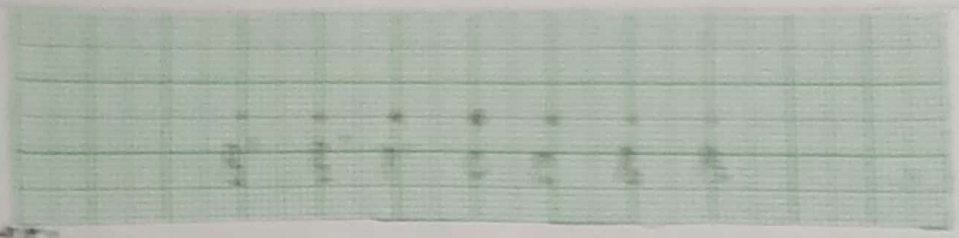
S No.	order of diffraction (n)	Position of nth order maxima		Mean distance of n th order maxima from zeroth order (OP_n)	Distance between grating and screen (D) (cm)	$\sin\theta_n = \frac{OP_n}{\sqrt{OP_n^2 + D^2}}$	$d = n\lambda/\sin\theta$ (cm)
		on left (OP_n') (CM)	on right (OP_n^2) (CM)				
1	1	1	1	1	75	1/75.006	4.87×10^{-3}
2	2	2	2	2	75	2/75.026	4.87×10^{-3}
3	3	3	3	3	75	3/75.05	4.87×10^{-3}

6. CALCULATIONS:

$$\sin\theta = \frac{1}{\sqrt{1^2+75^2}} = \frac{1}{75.006} \quad \text{and} \quad d_1 = \frac{1 \times 650 \times 10^{-7} \times 75.006}{1} = 4.8753 \times 10^{-3} \text{ cm}$$

$$\sin\theta = \frac{2}{\sqrt{2^2+75^2}} = \frac{2}{\sqrt{2^2+75^2}} = \frac{2}{75.026} \quad \text{and} \quad d_2 = \frac{2 \times 650 \times 10^{-7}}{2} \times 75.026 = 4.8766 \times 10^{-3} \text{ cm}$$

$$\sin\theta = \frac{3}{\sqrt{3^2+75^2}} = \frac{3}{75.05} \quad \text{and} \quad d_3 = \frac{3 \times 650 \times 10^{-7} \times 75.026}{3} = 4.8752 \times 10^{-3} \text{ cm}$$



5. Percentage Error:

$$\%\text{error} = \frac{|\text{Standard value} - \text{observed value}|}{\text{Standard value}} \times 100\ \%$$

$$\%\text{error} = \frac{|0.5458 - 0.5187|}{0.5458} \times 100\% \Rightarrow \%\text{error} = 4.11\%$$

6. Results: Grating element $d = 4.57 \times 10^{-3}$ cm

We found out a diffraction grating has a very large number of equally spaced slit. When parallel light is incident on diffraction grating each slit is source of diffracted waves. These waves therefore interact with one another. Diffracted light shows on a distant screen which has a central bright spot labelled $m=0$ and a higher order bright fringe that can also be observed.

7. Sources of Error.

Source of errors can be:-

1. Performing experiment in a bright room.
2. Not measuring the distance between screen and grating element accurately.
3. Use of different units.

10. Precautions.

1. Laser light should not fall on the eyes of observer directly.
2. All length should be measured in same units
3. Distance between the spot should be measured accurately.

ing outcomes (What I have learnt):

- It will provide the modest experience that allows students to develop and improve their experimental skills and develop ability to analyze data.
- 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 in physics.
- 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 the experiment.
- Students will develop skills by the practice if setting up and conducting an experiment with due regards to minimizing measurement error.

Evaluation Grid:

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Student Performnce (Conduct of experiment)	12	11.5
2.	Viva Voce	10	05
3.	Submission of Work Sheet (Record)	8	7.5
4	Total Marks	30	24
5	Teacher's Signature (with date)		12/5

Experiment Number- 03

Student Name: [redacted]
Branch: BE-[redacted]
Semester: 01
Subject Name: Physics for Engineers Lab
UID: 2[redacted]
Section/Group: 411-A
Date of Performance: 12/09/2022
Subject Code: 22SPH-141

Aim of the Experiment: To determine numerical aperture of an optical fibre.

Apparatus:

SN.	Equipment	Range	Quantity
1	Power supply	0-12 V	1
2	Diode Laser	650 nM	1
3	Optical fibre cable	1 M	1
4	Stand	NA	2
5.	Detector	NA	1
6	Angular Deflection	0-360°	1

Formula:

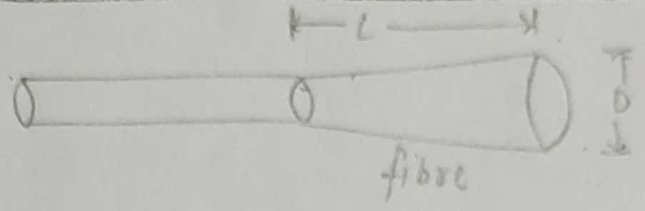
Using Snell's law, the maximum angle within which light will be accepted into and guided through fibre is -

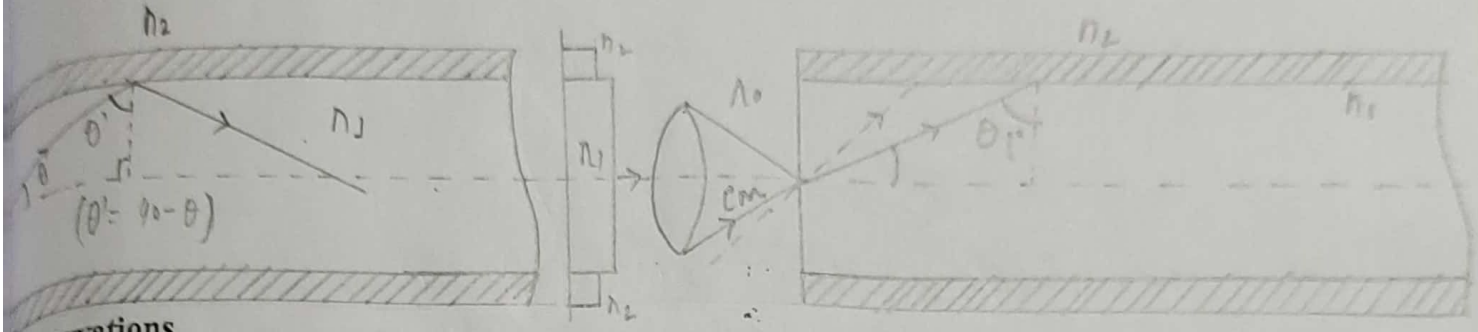
$$NA = \sin(\theta_a)$$

Where NA = Numerical Aperture

θ_a = Maximum angle within which light will be accepted.

Diagram:





Observations

S.No	Angular Deflection		Detector Reading	
	left	Right	left	Right
1	0°	0°	1.93°	1.93°
2	-1°	+1°	1.74°	1.77
3	-2°	2°	1.47°	1.58
4	-3°	3°	1.03°	1.11
5	-4°	4°	0.30°	0.27
6	-5°	5°	0	0

CALCULATIONS:

$\theta' = \frac{I_{max}}{2.77} = \frac{1.93}{2.77} = 0.7121$

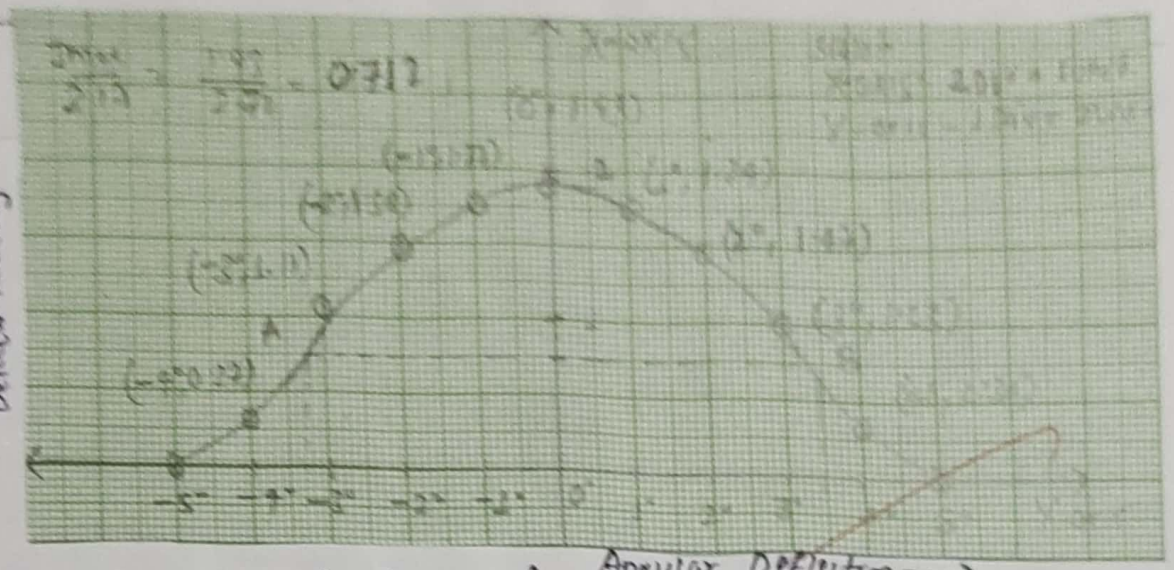
Mean value of $\theta = \left(\frac{3.5 + 3.4}{2}\right)$

Mean value of $\theta = 3.15$

$NA = \sin(\theta_a) = \sin(3.150)$

$\Rightarrow NA = 0.0549$

RAPH :



esults The Numerical Aperture of given optical fibre = 0.0549

ources of Error.

1. Optical source not aligned properly with the cable.
2. Stand not fixed properly.
3. Disturbing the apparatus frequently.

Precautions.

1. Optical source should be properly aligned with cable.
2. Distance of launch point from cable should be properly selected to ensure maximum amount of power is transfered to the cable.
3. The optical cable provided should be handled carefully so to avoid cracks.

rning outcomes (What I have learnt):

It will provide the modest experience that allows students to develop and improve their experimental skills and develop ability to analyze data.
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 in physics.
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 the experiment.
Students will develop skills by the practice if setting up and conducting an experiment with due regards to minimizing measurement error.

Evaluation Grid:

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Student Performnce (Conduct of experiment)	12	10.5
2.	Viva Voce	10	7.5
3.	Submission of Work Sheet (Record)	8	7
4	Total Marks	30	25
5	Teacher's Signature (with date)		27/7/22

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Experiment Number- 04

Student Name: [redacted] UID: [redacted]
Branch: BE-[redacted] Section/G[redacted]
Semester: 01 Date of Performance: 26/09/2022
Subject Name Physics for Engineers Lab Subject Code: 22SPH-141

1. Aim of the Experiment: To calculate the velocity of ultrasonic sound through different liquid media.

2. Apparatus:

SN.	Equipment	Range	Quantity
1	Ultrasonic inferometer	~~2MHz~~	1
2	Sample liquids	20ml	1
3	Power supply	220V	1

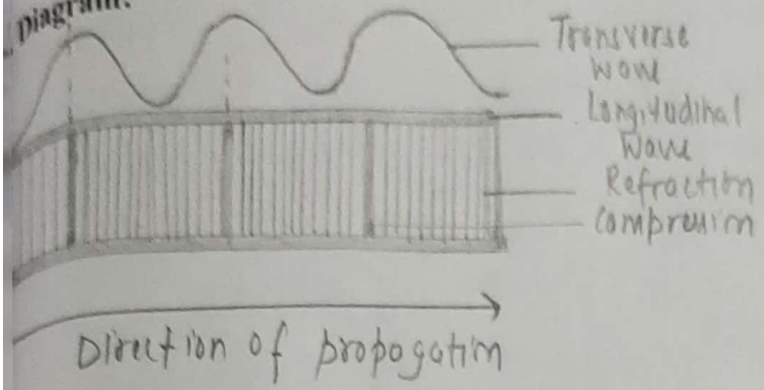
3. Formula:

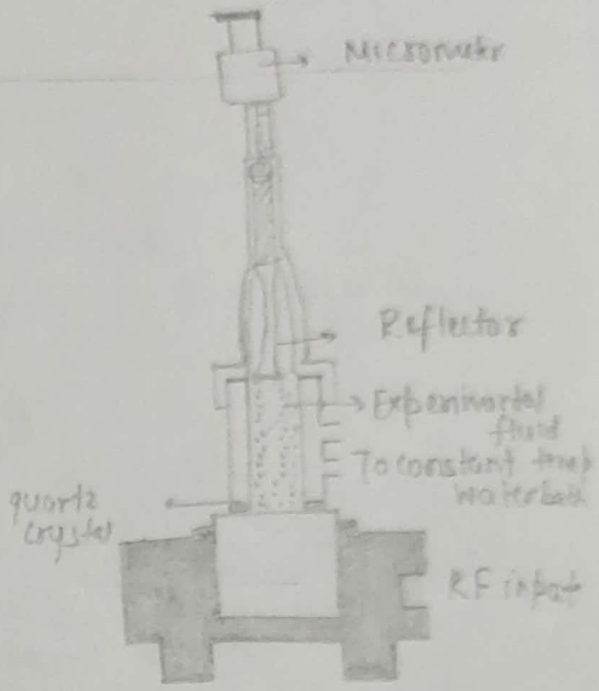
The velocities of a wave is related to its wavelength (λ) by relation,

$$V = \lambda f = 2df$$

Where, d is the separation between successive adjacent maxima of anode current.

Diagram:





5. Observations

1. Least count of main scale = 0.5 MM
2. Least count of circular scale = 0.5
3. Least count on screw gauge = Pitch / no. of divison = 0.01 MM
4. Frequency of ultrasound used = 2 MHz
5. Medium used = water ; Density = 996.458 kg/m3
6. Here, Gain = 20 and adjustment = 80
   Adjustment always greater than Gain.

SNo	Micro meter Reading corresponding to maxima (mm)	Difference between consecutive Maxima $d = \lambda/2$ (mm)
1	$N_1 = 0.37$	$N_2 - N_1 = 0.43$
2	$N_2 = 0.80$	$N_3 - N_2 = 0.44$
3	$N_3 = 1.23$	$N_4 - N_3 = 0.43$
4	$N_4 = 1.66$	$N_5 - N_4 = 0.44$
5	$N_5 = 2.09$	Mean = 0.435

Calculations:

Mean = Sum of readings / No. of readings

Mean = $(0.43 + 0.44 + 0.43 + 0.44)/4 = 0.435$ mm

Velocity = $\lambda f = 2df$

Velocity = $2 \times 0.435 \times 10^{-3} \times 2 \times 10^{6}$

Velocity = 1740 M/S

Percentage Error:

$$\text{Percentage error} = \left(\frac{\text{standard value} - \text{Experimental value}}{\text{standard value}}\right) \times 100$$

$$= \left(\frac{1740 - 1480}{1480}\right) \times 100 = 17.56\%$$

9. Result:

(i) The calculated ultrasonic wave velocity through the given medium is 1740 M/S.

(ii) The standard value of ultrasonic wave is 1480 M/S

10. Sources of Errors:

(i) There must be some error during readings of a measuring device.

(ii) Not positioning of reflector correctly.

(iv) Loose connections.

10. Precautions.

(i) The middle portion of the ultrasonic interferometer should be thoroughly cleaned and filled with liquid.

(ii) Do not use acidic medium for performing the experiment.

(iii) Wait for five minutes, after instruct is switched ON, and then start making the adjustment, and noting down the readings.

(iv) Lower side reading is to be taken on the micrometer scale.

rning outcomes (What I have learnt):

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- Students will develop skills by the practice if setting up and conducting an experiment with due regards to minimizing measurement error.

Evaluation Grid:

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Student Performnce (Conduct of experiment)	12	10.5
2.	Viva Voce	10	7.5
3.	Submission of Work Sheet (Record)	8	7
4	Total Marks	30	25
5	Teacher's Signature (with date)		31/10/22

EXPERIMENT NUMBER - 05

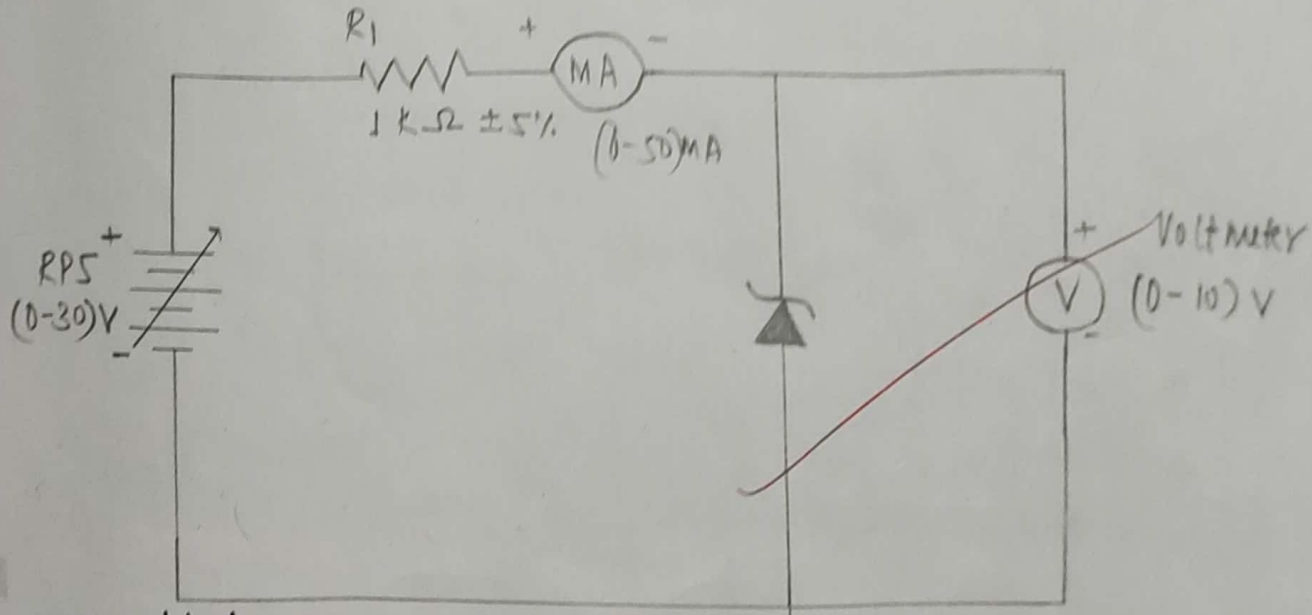
Student Name: [redacted]	UID: [redacted]
Branch: BE- CSE (Hons)	Section/Group: 411-A
Semester: 01	Date of Performance: 03/10/2022
Subject Name: Physics for Engineers lab	Subject Code: 22SPH-141

AIM OF THE EXPERIMENT - To draw reverse characteristics of zener diode.

APPARATUS-

SN.	Equipment	Range	Quantity
1	Regulated Power supply	0-30 V	1
2	Zener Diode	3V/5V/9V	3
3	Voltmeter	0-30V	1
4	Ammeter	0-50MA	1
5	connecting wires	NA	1
6	Resistance	1kΩ	1

DIAGRAM-

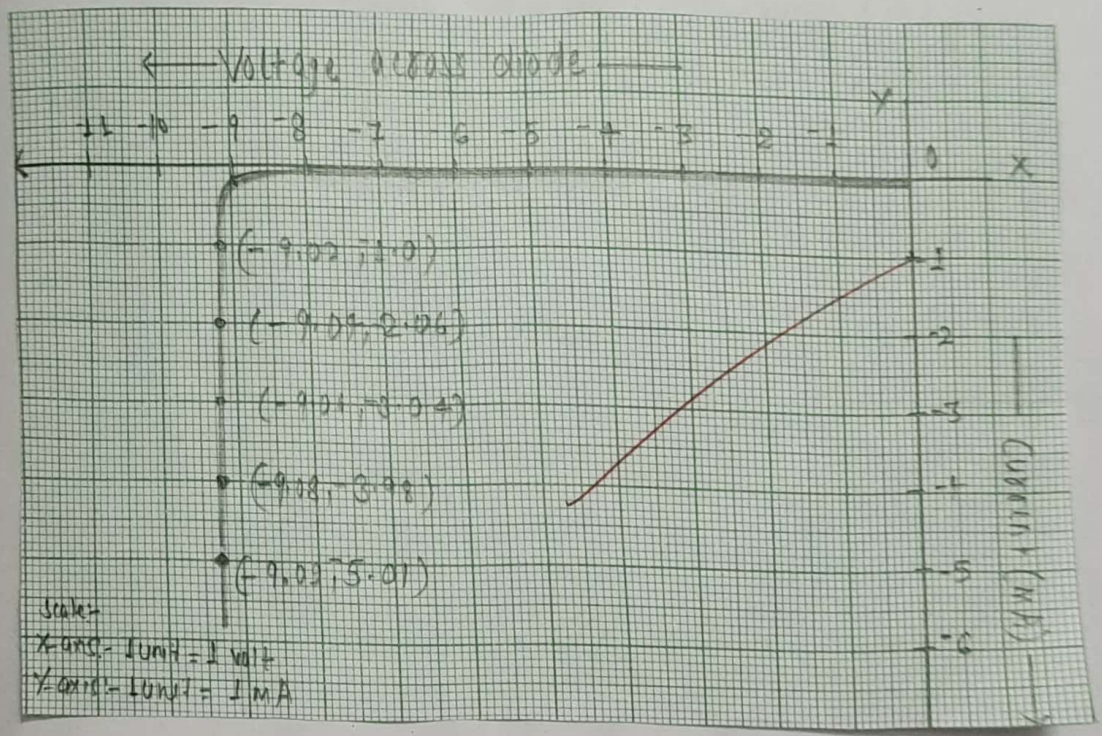


zener diode reverse characteristics diagram.

OBSERVATIONS-

S.N.	Reverse Voltage Across the diode V_{zr} (Volts)	Reverse Current through the diode I_{zr} (mA)
1.	0	0
2.	1	0
3.	2	0
4.	3	0
5.	5	0
6.	8	0
7.	9	0.07
8.	9.02	1.00
9.	9.04	2.06
10.	9.06	3.04
11.	9.08	3.98
12.	9.09	5.01

GRAPH- From graph breakdown Voltage = 9V



RESULTS- The value of breakdown voltage from graph is 9V.
The V-I characteristics of zener diode indicates that characteristics of zener diode in reverse bias have a negligible constant current flow through it but the current becomes abruptly large at zener voltage (V_2).

SOURCES OF ERROR-

(i) Excessive temperature or high current.
(ii) faulty circuit and loose wires.
(iii) The ammeter and volt meter not connected properly

PRECAUTIONS- (i) Excessive flow of current may damage the diode.
(ii) Current for sufficiently long time may change the characteristi
(iii) Connections should be made neat and clean.

LEARNING OUTCOMES

- It will provide the modest experience that allows students to develop and improve their experimental skills and develop ability to analyze data.
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- Students will develop skills by the practice of setting up and conducting an experiment with due regards to minimizing measurement error.

EVALUATION COLUMN (To be filled by concerned faculty only)

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Student Performance (Conduct of experiment)	12	11.5
2.	Viva Voce	10	9.5
3.	Submission of Work Sheet (Record)	8	7.5
4.	Total Marks	30	28.5
5.	Teacher's Signature (with date)		16/10

EXPERIMENT NUMBER – 06

Student Name: [redacted] UID: [redacted]
Branch: BE-[redacted] Section/Group: 433-A
Semester: 01 Date of Performance: 10/10/2022
Subject Name: Physics for Engineers LAB Subject Code: 22SPH-141

AIM OF THE EXPERIMENT – Determination of value of Planck's constant 'h' using photo cell.

APPARATUS-

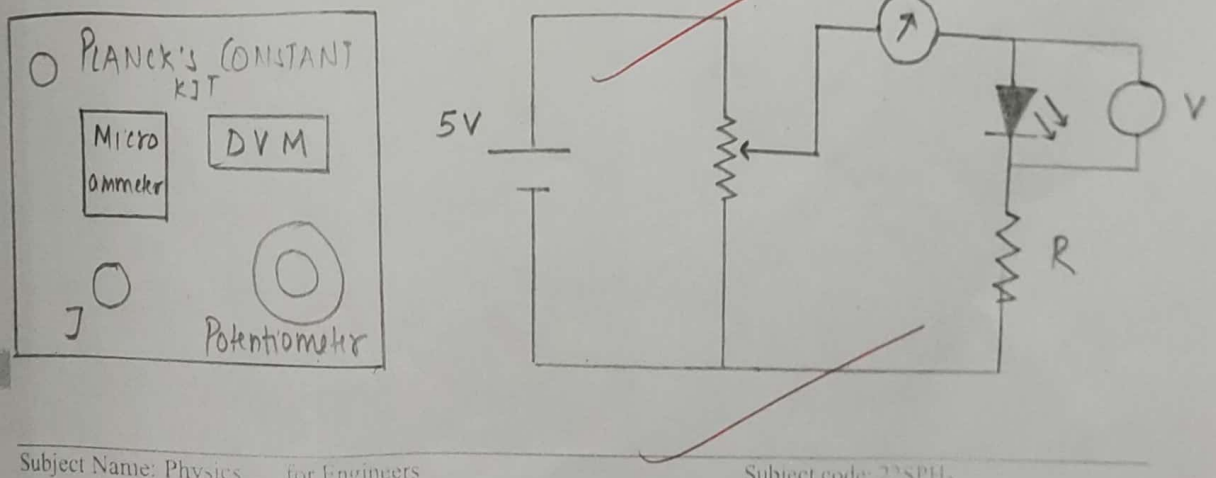
S.N.	Equipment	Range	Quantity
1	Digital Voltmeter (DVM) to measure the voltage across LED.s	0-20V	1
2	Mirco-ammeter to determine the current through LED.s	30MA	1
3	Jack J to connect the LED.s	Different colors	4

FORMULA USED-

$E = h\upsilon$
$E = eV$
$\upsilon = \frac{c}{\lambda}$

where, h = Planck's constant
υ = frequency
c = speed of light
λ = wavelength
e = Charge of electron
$e = 1.6 \times 10^{-19} C$

DIAGRAM-



OBSERVATIONS-

Colour	Wavelength λ (nm)	$1/\lambda$ (m^{-1})	Stoppage voltage (V)	Energy (J) $E = eV$	Frequency $\nu = c/\lambda$ (Hz)	$h = \frac{eV\lambda}{c}$ (Js)
Red	650nM	1.538×10^6	1.36	2.176×10^{-19}	4.614×10^{14}	4.715×10^{-34}
Yellow	570 nM	1.75×10^6	1.57	2.52×10^{-19}	5.25×10^{14}	4.78×10^{-34}
Green	510 nM	1.960×10^6	1.65	2.64×10^{-19}	5.88×10^{14}	4.489×10^{-34}
Blue	500nM	2×10^6	1.96	3.136×10^{-19}	6×10^{14}	5.226×10^{-34}

CALCULATIONS-

$\frac{6 \times 8.176 \times 10^{-19} \times 510 \times 10^{-9}}{3 \times 10^8} = 4.715 \times 10^{-34}$ Js

$\frac{1.57 \times 650 \times 10^{-9} \times 10^{-19}}{3 \times 10^8} = 4.78 \times 10^{-34}$ Js

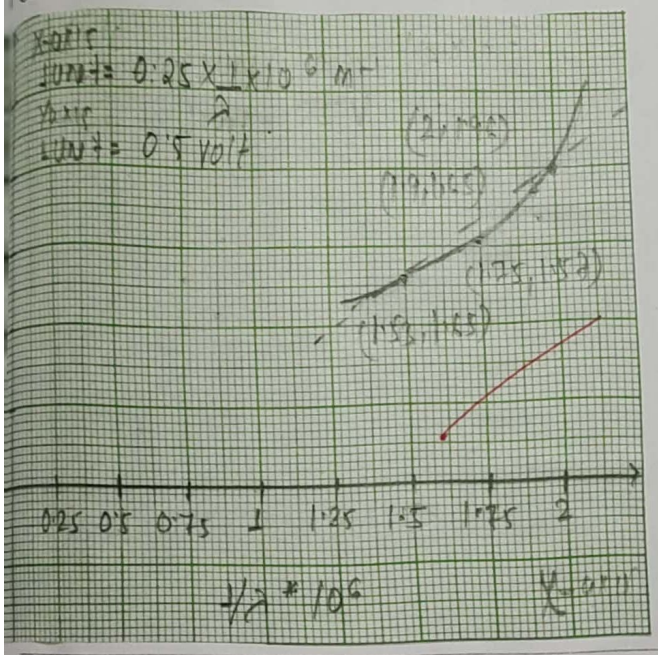
$\frac{2.64 \times 510 \times 10^{-19} \times 10^{-9}}{3 \times 10^8} = 4.489 \times 10^{-34}$ Js

$\frac{3.136 \times 500 \times 10^{-19} \times 10^{-9}}{3 \times 10^8} = 5.226 \times 10^{-34}$ Js

Mean value of $h = \frac{4.715 + 4.78 + 4.489 + 5.226}{4}$

$\Rightarrow h = 4.8025 \times 10^{-34}$ Js

GRAPH-



Slope $M = \frac{y_2 - y_1}{x_2 - x_1} = \frac{V}{1/\lambda} = V\lambda$

$V\lambda = \frac{1.96 - 1.36}{(2 - 1.53) \times 10^6} = 1.27 \times 10^{-5}$

Now $h = \frac{e}{c}(\lambda V)$

$h = \frac{1.6 \times 10^{-19}}{3 \times 10^8} \times 1.27 \times 10^{-5}$

$h = 6.80 \times 10^{-34}$ Js

PERCENTAGE ERROR-

$$\%age\ Error = \left|\frac{standard\ value - Experimental\ value}{standard\ value}\right| \times 100$$

$$= \left|\frac{6.626 \times 10^{-34} - 6.808 \times 10^{-34}}{6.626 \times 10^{-34}}\right| \times 100 = 2.746\%$$

RESULTS- The value of Planck's constant $h = 6.818 \times 10^{-34}$ Js

Our experimental value of Planck's constant was well within the limits set by experimental uncertainty.

SOURCES OF ERROR-

(i) The experiment should be performed in dark room such that the glow of led is visible properly.

(ii) The value of ammeter and voltmetir should be noted with least count.

(iii) Error in taking the readings.

PRECAUTIONS-

(i) The experiment should be performed such that the glow of LED is visible properly.

(ii) Smooth graphs should be plotted.

LEARNING OUTCOMES

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- Students will develop skills by the practice of setting up and conducting an experiment with due regards to minimizing measurement error.

EVALUATION COLUMN (To be filled by concerned faculty only)

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Student Performance (Conduct of experiment)	12	11
2.	Viva Voce	10	9
3.	Submission of Work Sheet (Record)	8	7
4.	Total Marks	30	27
5.	Teacher's Signature (with date)		7/11

EXPERIMENT NUMBER – 07

Student Name: [redacted] UID: [redacted]
Branch: BE- Section/Group: [illegible]
Semester: 01 Date of Performance: 07/10/2022
Subject Name: Physics for Engineers lab Subject Code: 22SPH-141

AIM OF THE EXPERIMENT – To determine Hall voltage and Hall coefficient using Hall effect.

APPARATUS-

SN.	Equipment	Range	Quantity
1	Constant current Power supply	4A & 50V	1
2	Hall probe	NA	1
3	Digital gauss meter	2-20k gauss	1
4	n-type Germanium crystal	0.7eV	1
5	Electromagnet	Na	1
6	Power supply for crystal	0-8MA & 0-200mV	1

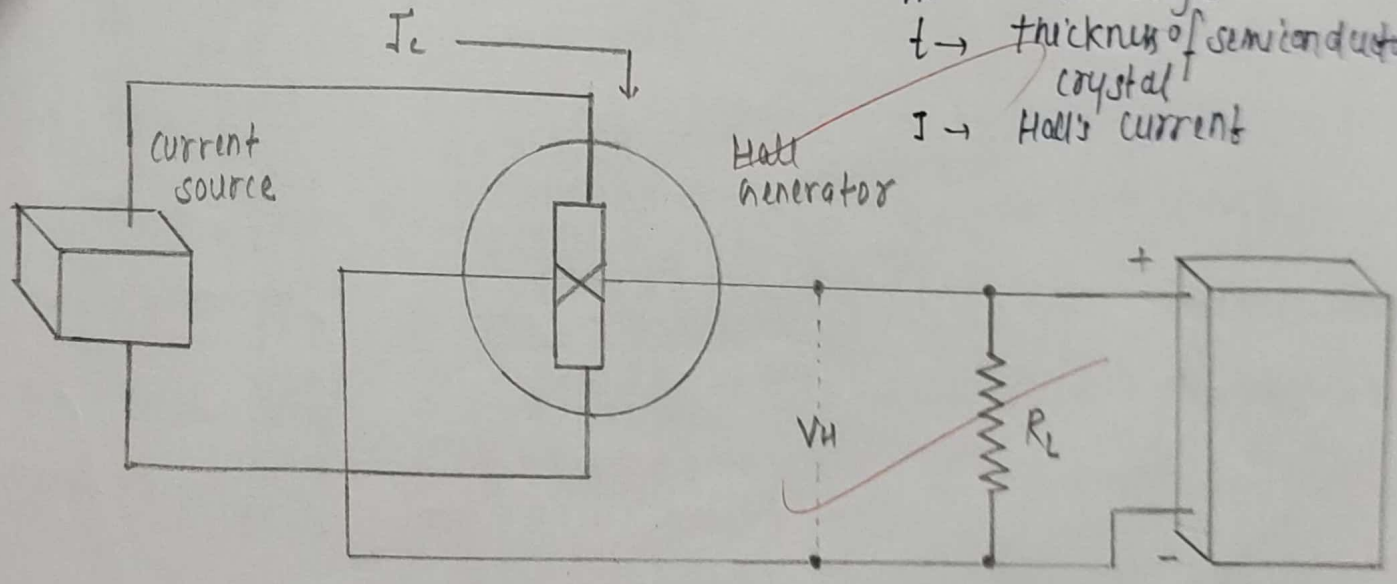
FORMULA USED-

Hall voltage $V_H = E_W = V_{BW} = \frac{IB}{net}$

$R_H = \frac{V_H * t}{I * B}$

Where R_H is called Hall coefficient
B → Magnetic field
V_H → Hall's voltage
t → thickness of semiconductor crystal
I → Hall's current

DIAGRAM-



Schemantic representation of Hall effect in a conductor

OBSERVATIONS-

SN	Current I (A)	Magnetic Field H (Tesla)
1.	0.5	0.31
2	1.0	0.62
3	1.5	0.95
4.	2.0	1.25

Thickness of sample (t) = 0.70mm = 0.7×10^{-3} m

SN	Magnetic Field (Tesla)	Hall current (mA)	Hall Voltage (mV)	$R_H = \frac{V_H * t}{I * B}$ (Volt m / ampere)
1	1.25	3	1.1	2.053×10^{-4}
2	1.25	6	2.2	2.053×10^{-4}
3	1.25	9	3.4	2.115×10^{-4}
4	1.25	12	4.5	2.100×10^{-4}
5	1.25	15	5.6	2.090×10^{-4}
6	1.25	18	6.8	2.115×10^{-4}

CALCULATIONS-

(i) $R_H = \frac{V_H * t}{I * B} = \frac{1.1 \times 10^{-3} \times 0.7 \times 10^{-3}}{3 \times 10^{-3} \times 1.25} = 2.053 \times 10^{-4}$ Volt m/ampere

(ii) $R_H = \frac{V_H * t}{I * B} = \frac{2.2 \times 10^{-3} \times 0.7 \times 10^{-3}}{6 \times 10^{-3} \times 1.25} = 2.053 \times 10^{-4}$ Volt m/ampere

(iii) $R_H = \frac{V_H * t}{I * B} = \frac{3.4 \times 10^{-3} \times 0.7 \times 10^{-3}}{9 \times 10^{-3} \times 1.25} = 2.115 \times 10^{-4}$ Volt m/ampere

(iv) $R_H = \frac{V_H * t}{I * B} = \frac{4.5 \times 10^{-3} \times 0.7 \times 10^{-3}}{12 \times 10^{-3} \times 1.25} = 2.100 \times 10^{-4}$ Volt m/ampere

(v) $R_H = \frac{V_H * t}{I * B} = \frac{5.6 \times 10^{-3} \times 0.7 \times 10^{-3}}{15 \times 10^{-3} \times 1.25} = 2.090 \times 10^{-4}$ Volt m/ampere

(vi) $R_H = \frac{V_H * t}{I * B} = \frac{6.8 \times 10^{-3} \times 0.7 \times 10^{-3}}{18 \times 10^{-3} \times 1.25} = 2.115 \times 10^{-4}$ Volt m/ampere

Mean value of $R_H = \frac{(2.053 + 2.053 + 2.115 + 2.100 + 2.090 + 2.115) \times 10^{-4}}{6}$

Mean value of $R_H = 2.087 \times 10^{-4}$ Volt m/ampere

SULTS- Hall effect was verified, As long as the magnetic field and the current stayed below some threshold, there was linear relationship between voltage measured and current and B field applied- Hall coefficient of the material, $R_H = 2.087 \times 10^{-4}$ volt m/amp tesla.

URCES OF ERROR-

(i) Error due to parallax should be avoided while measuring thickness.

(ii) Current should be constant or it will give false value.

(iii) Taking magnetic field not constant may be one of the errors.

RECAUTIONS-

1. There should be no magnet, magnetic substances and current carrying conductor near the the apparatus.
2. The plane of the coil should be set in the magnetic meridian.
3. Current should remain constant and should be reversed for each observations.

LEARNING OUTCOMES

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EVALUATION COLUMN (To be filled by concerned faculty only)

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Student Performance (Conduct of experiment)	12	11.5
2.	Viva Voce	10	8
3.	Submission of Work Sheet (Record)	8	7.5
4.	Total Marks	30	27
5.	Teacher's Signature (with date)		5/11/22

EXPERIMENT NUMBER – 08

Student Name: [redacted]	UID: [redacted]
Branch: [redacted]	Section/Group: 411-A
Semester:	Date of Performance: 28/11/2022
Subject Name: Physics for Engineers	Subject Code: 22SPH-141

AIM OF THE EXPERIMENT – To measure the value of 'g' using Kater's pendulum.

APPARATUS-

SN	Equipment	Range	Quantity
1.	Kater's pendulum	120 cm	1
2.	Meter Rod	100 cm	1
3	Stop watch	NA	1

FORMULA USED-

The formula used for the determination of acceleration due to gravity 'g':

$$g = \frac{8\pi^2}{\frac{t_1^2 + t_2^2}{l_1 + l_2} + \frac{t_1^2 - t_2^2}{l_1 - l_2}} \quad M/S^2$$

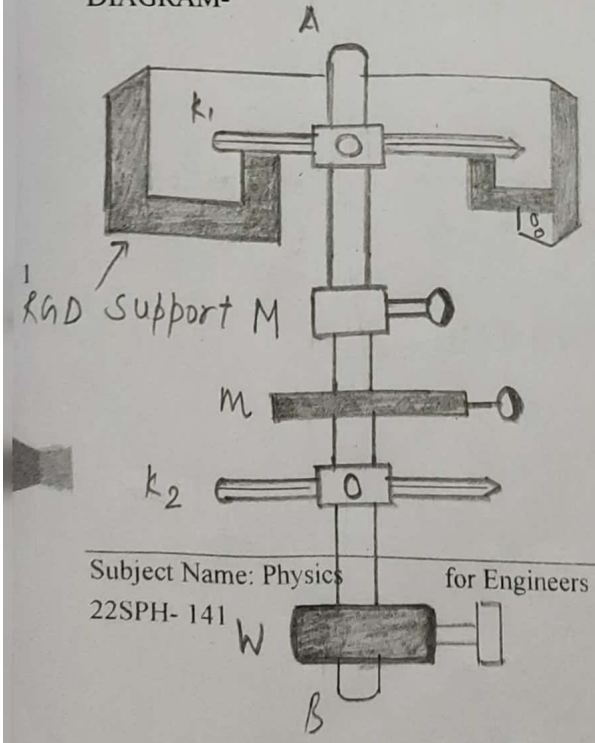
where t_1 → time period from knife edge k_1

t_2 → time period from knife edge k_2

l_1 → distance between knife edge k_1 and CG of pendulum

l_2 → distance between knife edge and CG of pendulum.

DIAGRAM-



OBSERVATIONS-

SN	No. of Oscillations	Time about the knife edge K_1	Time of one oscillation (sec)	Mean time T_1 sec	Time about the knife edge K_2	Time of one oscillation	Mean time T_2 sec
1.	20	36	1.8	1.8	34	1.7	1.71
2.	25	45	1.8		43	1.72	

CALCULATIONS-

(i) Distance Between K_1 and CG (l_1) = 60 cm

(ii) Distance between K_2 and CG (l_2) = 30 cm

$$g = \frac{8\pi^2}{\frac{T_1^2+T_2^2}{l_1+l_2} + \frac{T_1^2-T_2^2}{l_1-l_2}} \quad M/S^2$$

$$g = \frac{8\times 3.14\times 3.14}{\frac{(1.8)^2+(1.71)^2}{(0.6+0.3)} + \frac{(1.8)^2-(1.71)^2}{(0.6-0.3)}} \quad M/S^2$$

$$g = \frac{387.2}{387.198} \quad M/S^2$$

$$g = 10.0000517 \quad M/S^2$$

PERCENTAGE ERROR-

$$\text{Percentage error} = \frac{|\text{Standard value} - \text{calculated value}|}{\text{Standard value}} \times 100$$

$$\text{Percentage error} = \frac{|9.8 - 10.000517|}{9.8} \times 100 = 0.01\%$$

RESULTS-

Katers pendulum gives a very accurate value of gravity.
Acceleration due to gravity $g = 10\ m/s^2$.

SOURCES OF ERROR-

(i) Irregular oscillations of Katers pendulum.
(ii) Not using glass material as rigid support.
(iii) faulty apparatus and equipments.
(iv) Irregular centre of mass of Katers pendulum.

PRECAUTIONS-

1. The two knife edges should be parallel to each other.
2. To avoid friction there should be glass surface on rigid support
3. The amplitude of vibration should be small so that the motion of pendulum satisfies the condition of simple harmonic motion.
4. To avoid any irregularity of the motion the time period should be noted after the pendulum has made a few oscillations.

LEARNING OUTCOMES

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EVALUATION COLUMN (To be filled by concerned faculty only)

Sr. No.	Parameters	Maximum Marks	Marks Obtained
1.	Student Performance (Conduct of experiment)	12	11
2.	Viva Voce	10	8
3.	Submission of Work Sheet (Record)	8	7
4.	Total Marks	30	26
5.	Teacher's Signature (with date)		19/12/22

EXPERIMENT NUMBER – 09

Student Name: [redacted]	UID: [redacted]
Branch: [redacted]	Section/Group: [redacted]
Semester: [redacted]	Date of Performance: 5/12/2022
Subject Name: Physics for Engineers	Subject Code: 22SPH-141

AIM OF THE EXPERIMENT – To find resistivity of a semiconductor material using four probe method.

APPARATUS-

SN	Equipments	Range	Quantity
1	Power supply	220V	1
2	oven	0–200°C	1
3	n-Type Crystal	N/A	1
4	Milliammeter & Millivoltmeter	0–20mA & 0–250mV	1

FORMULA USED-

$R = \rho \frac{l}{A}$ where R → resistance, ρ → resistivity, l → length, A → area

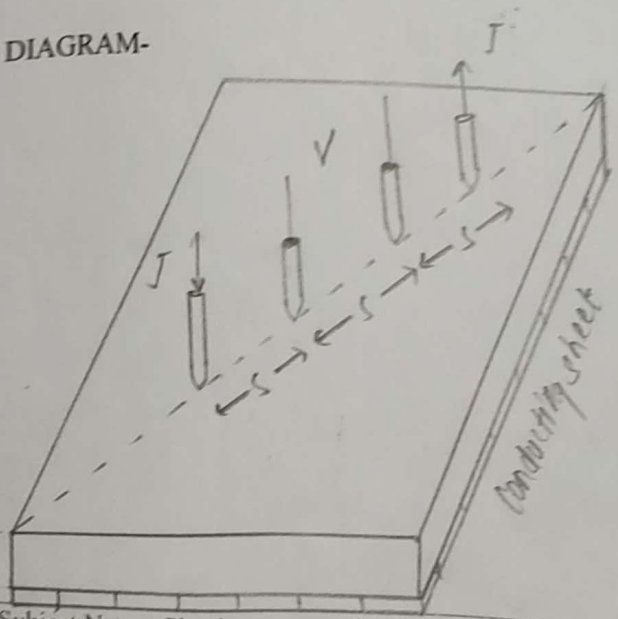
$\rho = \frac{\rho_0}{f(w/s)}$ $\rho_0 = \frac{V}{I} 2\pi s$

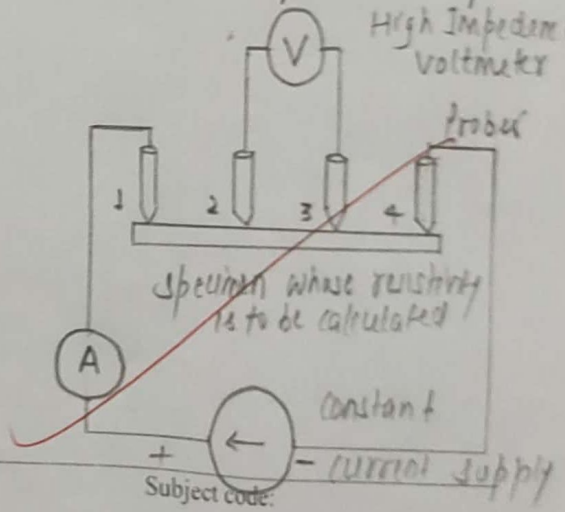
where V :- potential difference between inner probes

I :- current through outer pair of probes

s :- spacing between probes.

DIAGRAM-





OBSERVATIONS-

Sl	Temperature in °C	Temperature in Kelvin	Voltage (volts)	ρ_0 (ohm cm)	ρ
1	35	308	256 mV	107.26	8.21
2	40	313	232 mV	97.10	16.50
3	45	318	207 mV	86.73	14.72
4	50	323	182 mV	76.25	12.94
5	55	328	151 mV	63.26	10.74
6	60	333	125 mV	52.375	8.89
7	65	338	105 mV	43.99	7.46

CALCULATIONS-

(i) Distance between probes (S) = 0.2cm
(ii) Thickness of crystal chip (w) = 0.05 cm
(iii) current (I) = 3mA (Constant)

$2\pi S = 1.257$

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

$\rho_{01} = \frac{256 \times 10^{-3}}{3 \times 10^{-3}} \times 1.257 = 107.26$

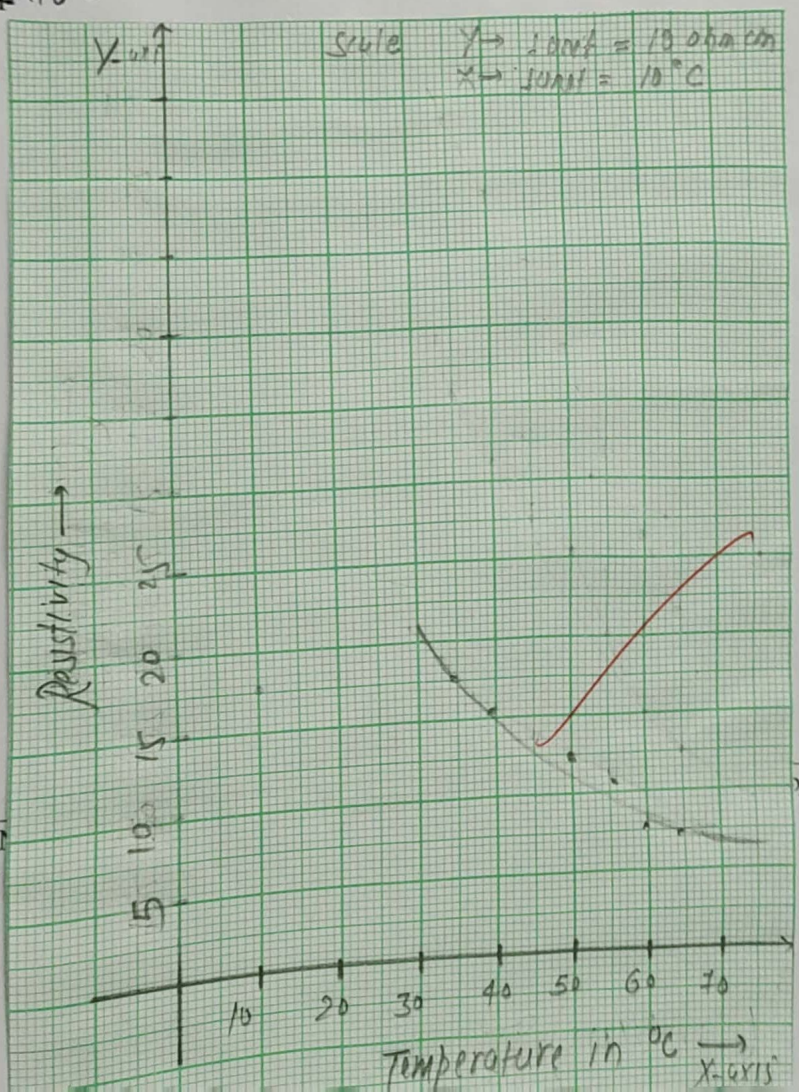
$= \frac{232 \times 10^{-3}}{3 \times 10^{-3}} \times 1.257 = 97.2080$ ohm cm

(iii) $\rho_{03} = \frac{207\,mV}{3\,mA} \times 1.257 = 86.733$ ohm cm

(iv) $\rho_{04} = \frac{182\,mV}{3\,mA} \times 1.257 = 76.258$ ohm cm

(v) $\rho_{05} = \frac{151\,mV}{3\,mA} \times 1.257 = 63.269$ ohm cm

GRAPH



Subject code:

Subject N
22SPH-

PERCENTAG ERROR-

— N.A —

RESULTS- Resistivity decreases exponentially with increase in temperature that is at low temperatures resistivity is more and at high temperature resistivity is less.

Resistivity of semiconductor material = 107.25 ohm cm at 35°C and 43.99 ohm cm at 65°C

SOURCES OF ERROR-

(i) Due to taking the 2nd set of reading instantly after the 1st set of reading.

(ii) Due to faulty equipments.

(iii) Due to setting the level of heating of oven high causes instant temperature increase.

PRECAUTIONS-

(i) The resistivity of material should be uniform in the area of measurement

(ii) The surface on which the probes rest should be flat with no surface leakage.

(iii) The diameter of the contact between the metallic probes and the semiconductor crystal chip should be small compared to distance between the probes.

LEARNING OUTCOMES

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