SOMAIYA VIDYAVIHAR UNIVERSITY
K J Somaiya College of Engineering

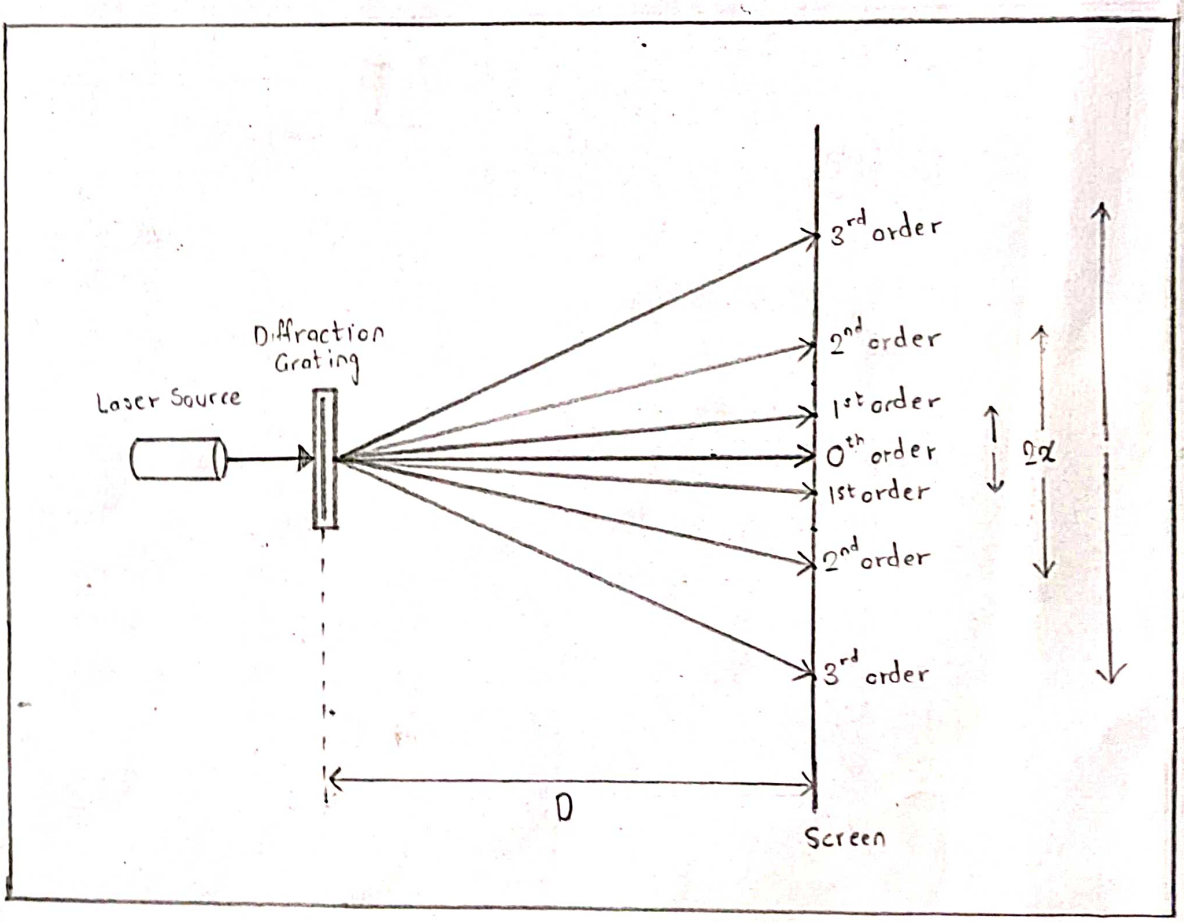
Name: Ritesh S. Jha
Roll Number: (17) 16010423076
Batch: P4_1 (IT)
Experiment performed on (date): 31/08/23

Title of the Experiment: Grating Constant

Aim: To determine the line density of a plane transmission diffraction grating.

Apparatus: Plane transmission diffraction gratings, laser source, screen and metre scale.

Diagram:



Observations:

Screen distance D = 25 cm

Sr No.	Order of maxima (m)	Separation of diffraction maxima from central maximum.		Angle of diffraction θ	sin θ
		2x (cm)	x (cm)		
1	1	3.6	1.8	4.11	0.071
2	2	7	3.5	7.96	0.138
3	3	10.6	5.3	11.96	0.207
4	4	14.6	7.3	16.27	0.280
5	5	18.6	9.3	20.40	0.348
6	6	22.8	11.4	24.5	0.414

Calculations:

To Find 'θ',

$\tan\theta = \frac{x}{D}$

$\therefore \tan^{-1}\left(\frac{x}{D}\right) = \theta$

① $\tan^{-1}\left(\frac{1.8}{25}\right) = 4.11$

② $\tan^{-1}\left(\frac{3.5}{25}\right) = 7.96$

③ $\tan^{-1}\left(\frac{5.3}{25}\right) = 11.96$

④ $\tan^{-1}\left(\frac{9.3}{25}\right) = 16.27$

⑤ $\tan^{-1}\left(\frac{9.3}{25}\right) = 20.40$

⑥ $\tan^{-1}\left(\frac{11.4}{25}\right) = 24.5$

$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{0.41 - 0.07}{6 - 1}$

$= \frac{0.34}{5} = 0.068$

$N = \frac{\text{slope}}{\lambda} = \frac{0.068}{640 \times 10^{-9}}$

$= 0.0001 \times 10^9$

To Find sin'θ',

① sin (4.11) = 0.071

② sin (7.96) = 0.138

③ sin (11.96) = 0.207

④ sin (16.27) = 0.280

⑤ sin (20.40) = 0.348

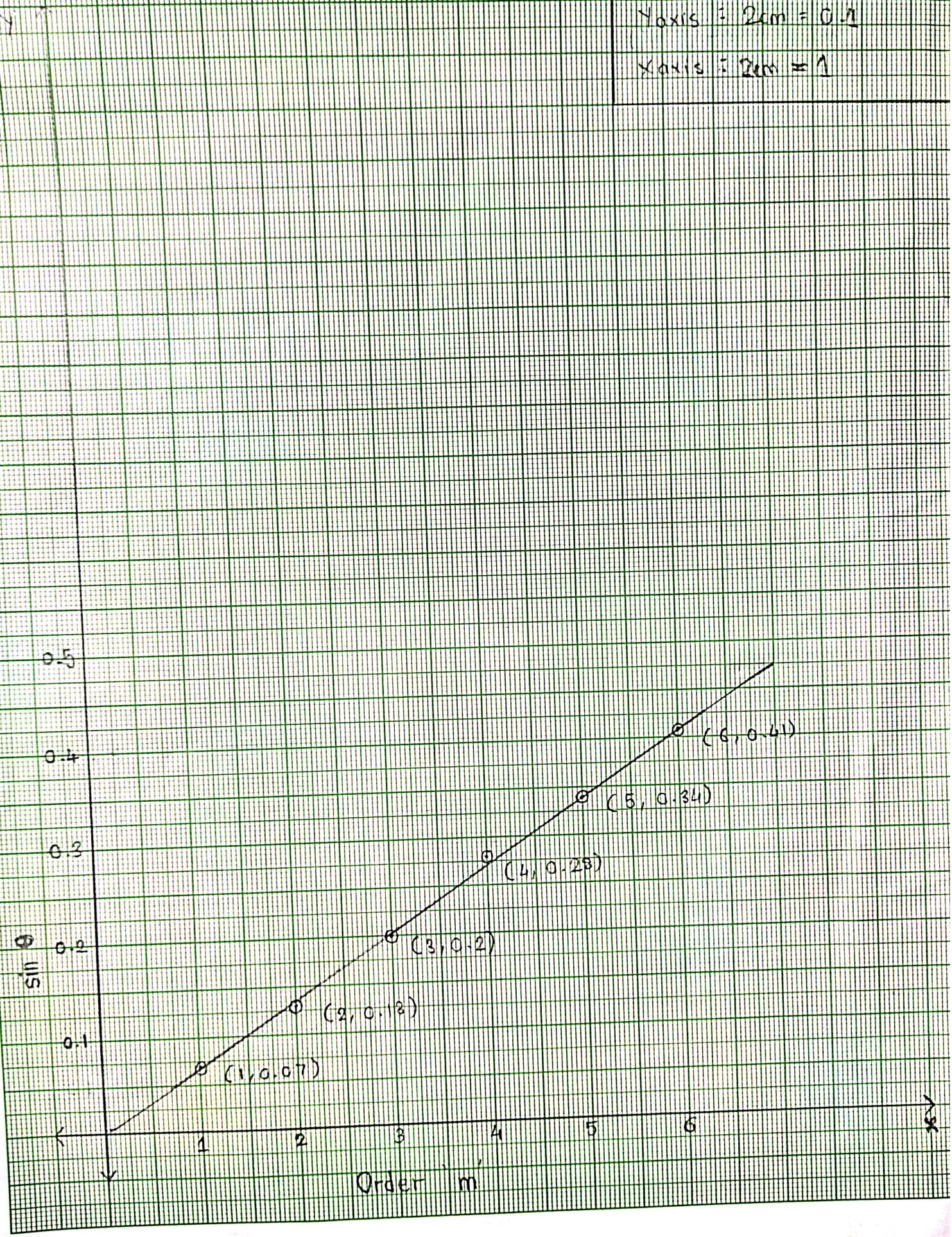
⑥ sin (24.5) = 0.414

Result/s and Conclusion/s: Line density of given diffraction gratings is $N = 108 \times 10^3$ lines/metre.

Scale

Y axis : 2cm = 0.1

X axis : 2cm = 1



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Name : Ritesh S. Jha

Course :

Experiment / assignment / tutorial No.

Grade: Signature of the Faculty with date

Assignment

Q1)

$N = \frac{\text{Slope}}{\lambda}$

We know that,

$\text{Slope} = \frac{\sin\theta}{m}$

$\therefore N = \frac{\sin\theta}{m\lambda}$

$\boxed{\theta = \sin^{-1}(Nm\lambda)}$

$\tan\theta = \frac{x}{D}$

$\boxed{x = D \times \tan\theta}$

$N = 0.0001 \times 10^9$ } Given

$\lambda = 532\,nm$

For $m = 1$
$\theta = 3.049$
$x = 1.33$

For $m = 2$
$\theta = 6.1$
$x = 2.671$

For $m = 3$
$\theta = 9.183$
$x = 4.041$

For $m = 4$
$\theta = 12.286$
$x = 5.444$

For $m = 5$
$\theta = 15.426$
$x = 6.898$

For $m = 6$
$\theta = 18.614$
$x = 8.420$

Sr No.	Order of maxima 'm'	Separation of diffraction maxima from central maximum		Angle of diffraction θ	$\sin\theta$
1		$2x'$(cm)	x'(cm)		
1	1	2.6	1.3	3.049	0.053
2	2	5.2	2.6	6.1	0.106
3	3	8.0	4.0	9.183	0.159
4	4	10.8	5.4	12.286	0.212
5	5	13.6	6.8	15.426	0.265
6	6	16.8	8.4	18.614	0.319

Q2) Given : $N = 1000$ lines/cm

$\lambda = 640\ nm = 640 \times 10^{-7}\ cm$

$\theta = \sin^{-1}(Nm\lambda)$ | $x = D \times \tan\theta$

For $m = 1$
$\theta = 3.669$
$x = 1.603$

For $m = 2$
$\theta = 7.354$
$x = 3.226$

For $m = 3$
$\theta = 11.069$
$x = 4.890$

For $m = 4$
$\theta = 14.832$
$x = 6.620$

For $m = 5$
$\theta = 18.662$
$x = 8.443$

For $m = 6$
$\theta = 22.581$
$x = 10.396$

Sr No	Order of maxima 'm'	Separation of diffraction maxima from central maximum		Angle of diffraction 'θ'	sin θ
		2x" (cm)	x" (cm)		
1	1	3.2	1.6	3.669	0.063
2	2	6.4	3.2	7.354	0.127
3	3	9.6	4.8	11.069	0.191
4	4	13.2	6.6	14.832	0.255
5	5	16.8	8.4	18.662	0.319
6	6	20.6	10.3	22.581	0.383

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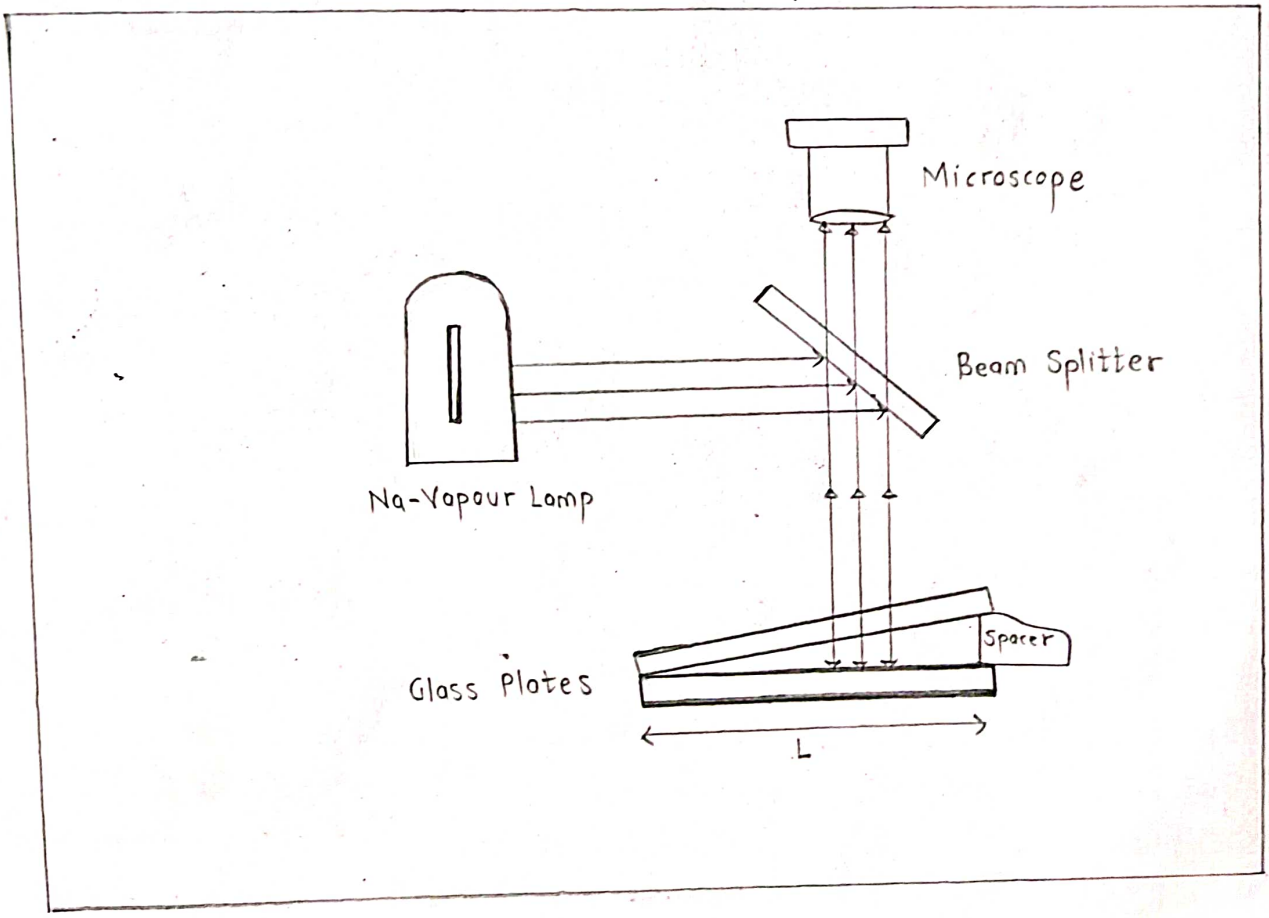
Name: Ritesh S. Jha
Roll Number: (17) 16010423076
Batch: P4 – 1
Experiment performed on (date): 14/09/23

Title of the Experiment: Wedge - Shaped Film

Aim: To determine fringewidth of the wedge shaped film interference pattern.

Apparatus: Wedge-shaped film set-up (two optically flat glass plates separated by a spacer at one end, beam-splitter with black box), monochromatic source (Na - vapour lamp), and travelling microscope.

Diagram:



Observations:

Sr No.	Dark fringe no (n)	Main Scale Reading M (cm)	Vernier Reading V = CD × LC* (cm)	Total Reading T_n = M + V (cm)
1	0	13.7	0.01	13.71
2	5	13.75	0.023	13.773
3	10	13.85	0.035	13.885
4	15	13.85	0.04	13.890
5	20	13.9	0.042	13.942
6	25	13.95	0.049	13.999
7	30	14	0.05	14.050
8	35	14.1	0.001	14.101

* CD – coinciding division
LC – least count

Calculations:

Slope = Fringewidth (β)

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{14.101 - 13.71}{35 - 0}$$

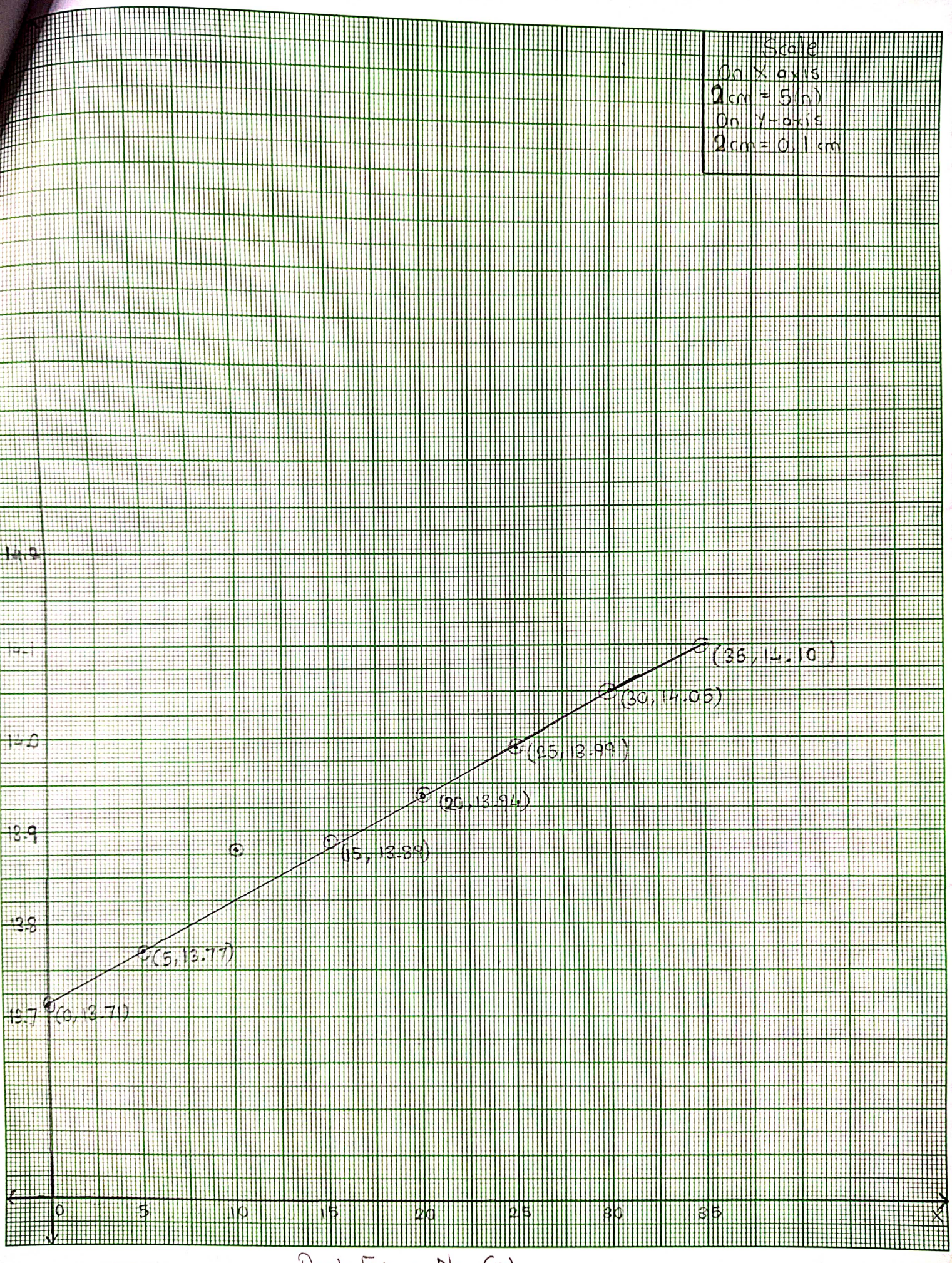
$$\text{Slope} = 0.01117$$

$$\beta = 1.117 \times 10^{-2} \text{ cm}$$

Total Readings

13.7 + 0.01 = 13.71
13.75 + 0.023 = 13.773
13.85 + 0.035 = 13.885
13.85 + 0.04 = 13.890
13.9 + 0.042 = 13.942
13.95 + 0.049 = 13.999
14 + 0.05 = 13.050
14.1 + 0.001 = 14.101

Result/s and Conclusion/s: The fringewidth of the wedge shaped film is 1.117×10^{-2} cm


Scale
On X axis
2 cm = 5 (n)
On Y-axis
2 cm = 0.1 cm
14.2
14.1
14.0
13.9
13.8
13.7
(0, 13.71)
(5, 13.77)
(15, 13.89)
(20, 13.94)
(25, 13.99)
(30, 14.05)
(35, 14.10)
0
5
10
15
20
25
30
35
X
Y
Total Reading (l)
Dark Fringe No (n)

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Assigment

Q1) $L = 4cm = 0.04m$

$\lambda = 589nm = 589 \times 10^{-9} m$

No. of fringes $= \frac{2L}{\lambda}$

$= \frac{2 \times 0.04}{589 \times 10^{-9}}$

No. of fringes $= 135823.4295$

Q2) $L = 4cm$

$\lambda = 589nm = 589 \times 10^{-7} cm$

$\beta = 1.117 \times 10^{-2} cm$

Thickness of spacer (d) $= \frac{\lambda L}{2\beta}$

$= \frac{589 \times 10^{-7} \times 4}{2 \times 1.117 \times 10^{-2}}$

$= 1054 \times 10^{-5} cm$

Thickness of spacer (d) $= 1.054 \times 10^{-2} cm$

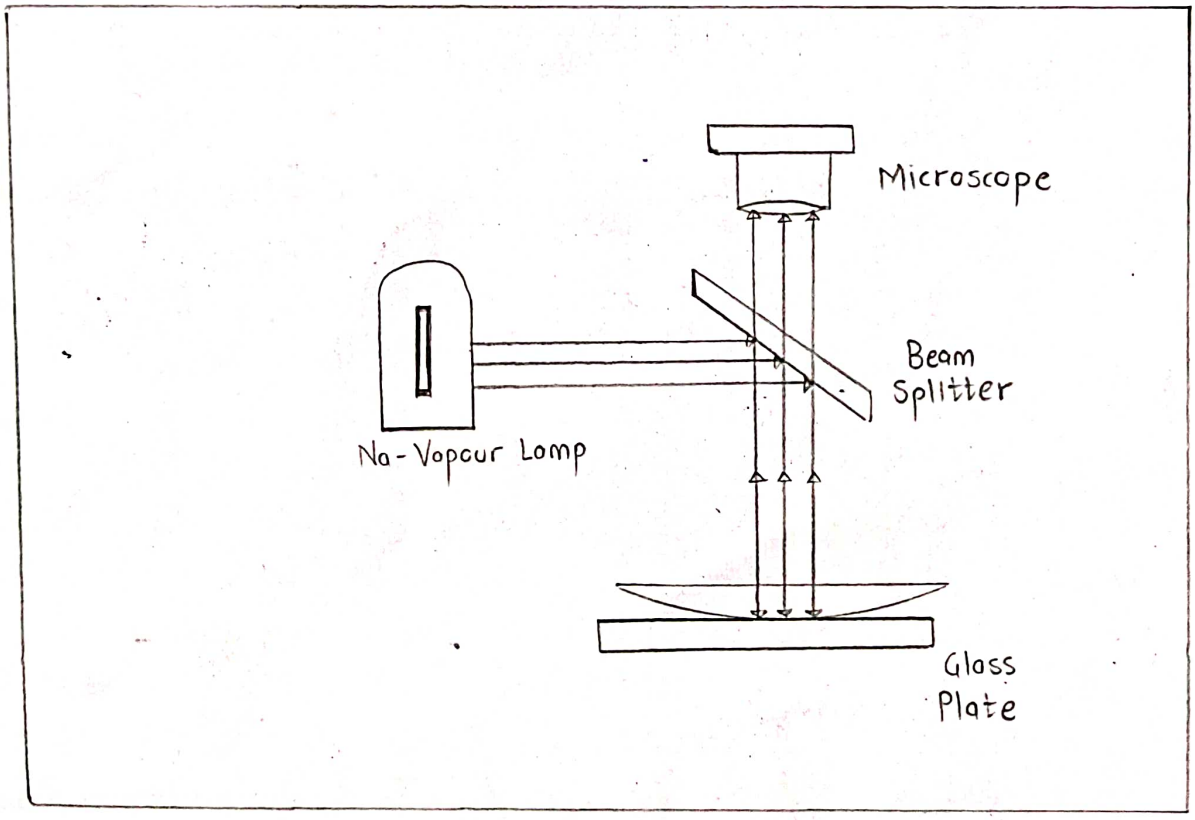
Name: Ritesh S. Jha
Roll Number: (17) 16010423076
Batch: P4-1
Experiment performed on (date):

Title of the Experiment: Newton's Rings

Aim: To determine radius of curvature of plano-convex lens by measuring diameters of interference rings.

Apparatus: Newton's rings set-up (pair of plane glass plate and plano-convex lens, beam-splitter with black box), monochromatic source (Na-vapour lamp), and travelling microscope.

Diagram:



Observations:

Sr No.	Ring No. (n)	Travelling Microscope Reading (cm)						Diameter D_n (cm) = L-R	D_n^2 (cm^2) (take 10^{-12} factor common)
		On Left L = M+V (cm)			On Right R = M+V (cm)				
		M	V	L	M	V	R		
1	10	10.85	0.024	10.874	10.50	0.017	10.517	0.357	12.74
2	8	10.85	0.003	10.853	10.50	0.045	10.545	0.308	9.48
3	6	10.80	0.047	10.847	10.55	0.01	10.560	0.287	8.23
4	4	10.80	0.008	10.808	10.55	0.04	10.590	0.218	4.75
5	2	10.75	0.028	10.778	10.6	0.018	10.618	0.160	2.56

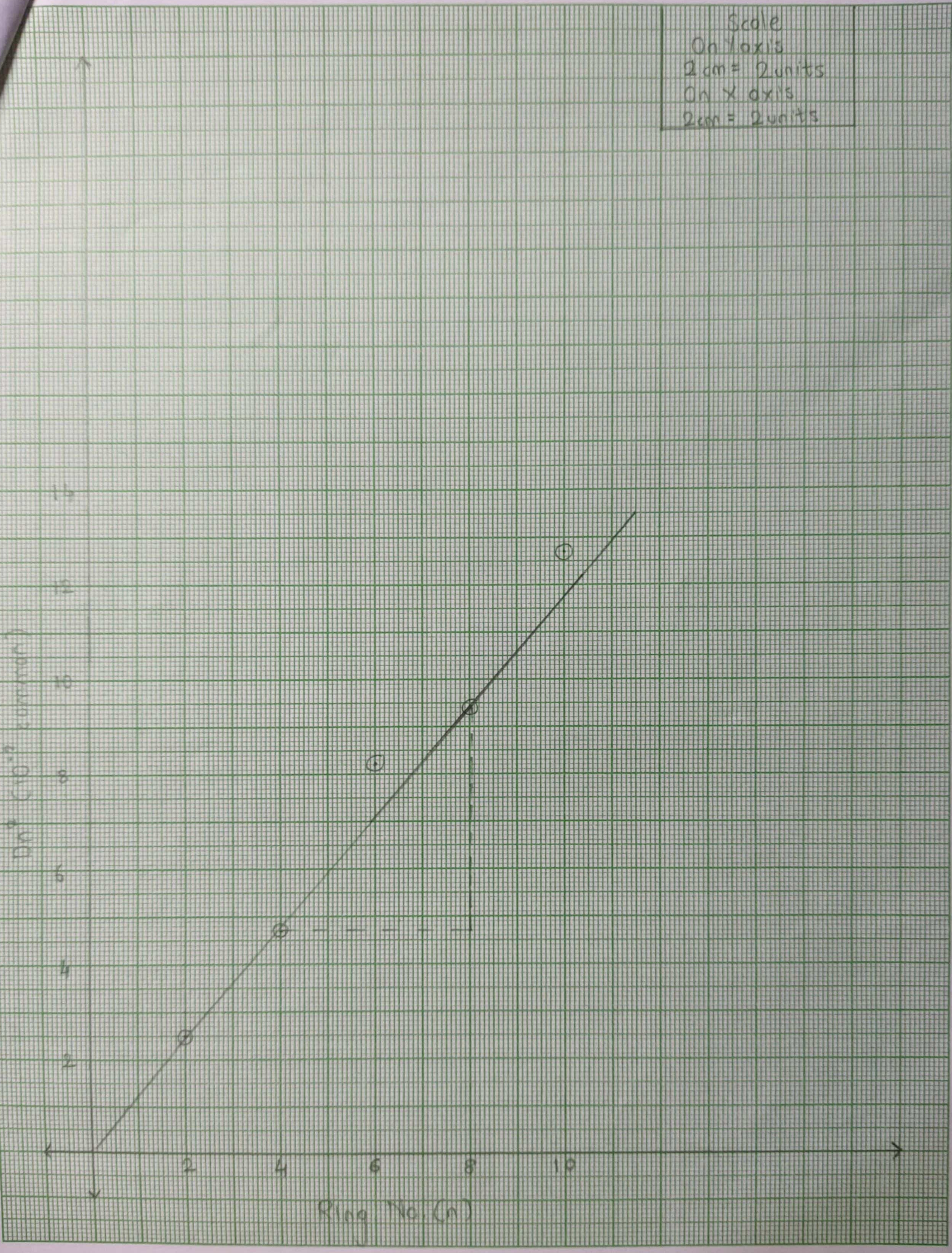
Calculations:

$(0.357)^2 = 0.127449$
$(0.308)^2 = 0.094864$
$(0.287)^2 = 0.082369$
$(0.218)^2 = 0.047524$
$(0.160)^2 = 0.0256$

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$
$$= \frac{9.48 - 4.75}{8 - 4}$$
$$= 1.1825$$

$$R = \frac{\text{Slope}}{4 \times \lambda}$$
$$= \frac{1.1825 \times 10^{-2}}{4 \times 589 \times 10^{-7}}$$
$$= 0.0005019 \times 10^5$$
$$= 50.19 \text{ cm}$$

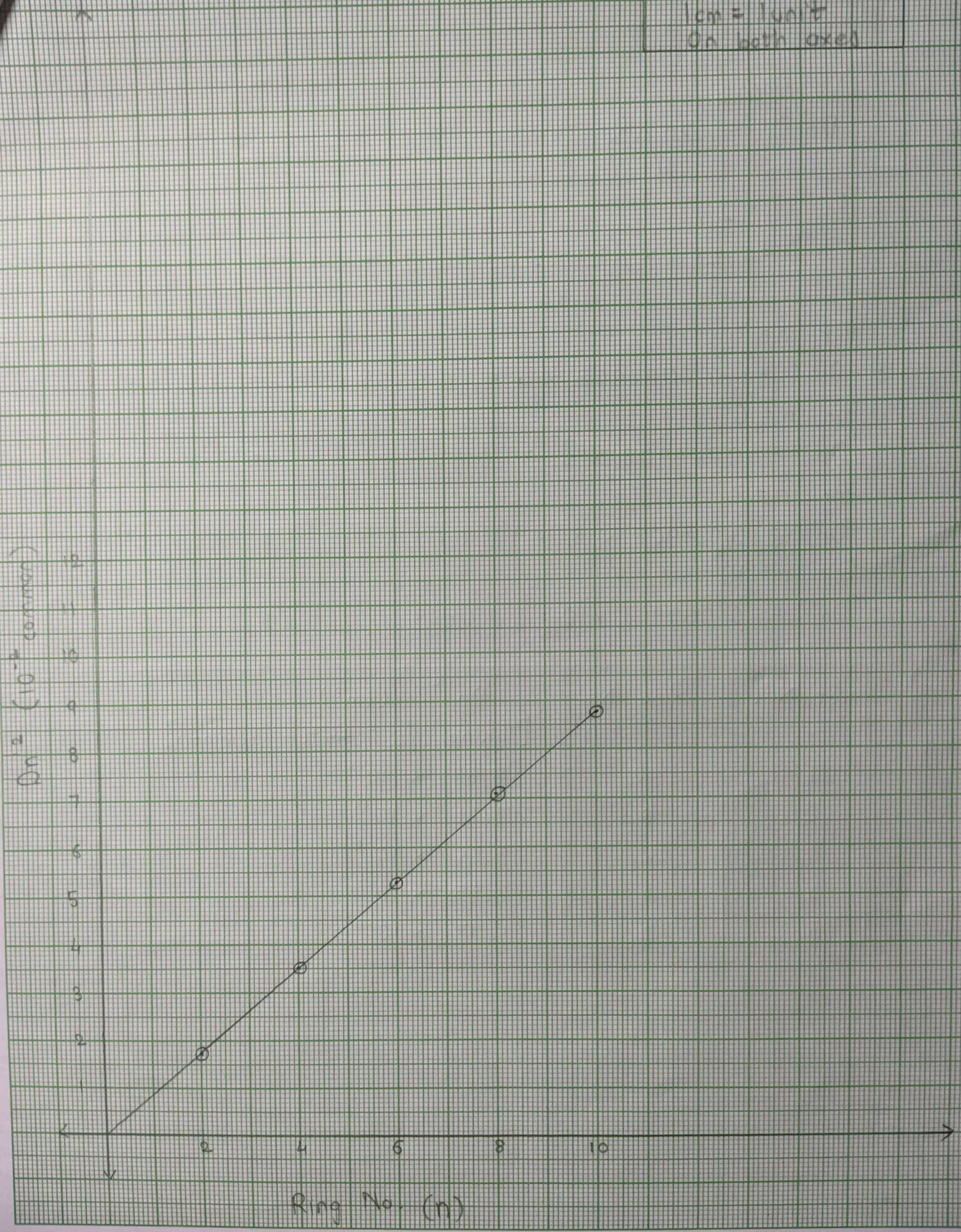
Result/s and Conclusion/s: The Radius of curvature of Plano-convex lens is 50.19 cm.



Scale
On Y axis
2 cm = 2 units
On X axis
2 cm = 2 units
2
4
6
8
10
12
14
2
4
6
8
10
Ring No. (n)

Assignment

Scale
1 cm = 1 unit
On both axes



P.T.O for calculation.

SUB. _____ DATE : _____

Assignment

$$D_n'^2 = \frac{4n\lambda R}{\mu}$$

For $n = 2$,

$$D_n'^2 = \frac{4 \times 2 \times 589 \times 10^{-7} \times 50.19}{1.33} = 0.0177 = 1.7 \times 10^{-2}$$

For $n = 4$,

$$D_n'^2 = 0.0088908 \times 4 = 0.0355 = 3.5 \times 10^{-2}$$

For $n = 6$

$$D_n'^2 = 0.008908 \times 6 = 0.0533 = 5.3 \times 10^{-2}$$

For $n = 8$

$$D_n'^2 = 0.008908 \times 8 = 0.0711 = 7.1 \times 10^{-2}$$

For $n = 10$

$$D_n'^2 = 0.008908 \times 10 = 0.0889 = 8.8 \times 10^{-2}$$

Sr No.	Ring No.	$D_n'^2$ (cm^2) [Taking 10^{-2} factor common]
1	10	8.89×10^{-2}
2	8	7.11×10^{-2}
3	6	5.33×10^{-2}
4	4	3.55×10^{-2}
5	2	1.77×10^{-2}

SIGN. _____