PHYSICS PRACTICAL SHEETS

Date 10th Oct 2023 ..... KU ..... CAMPUS
Class CE
Roll No. 25
Shift Afternoon
Object of the Experiment (Block Letter)

Experiment No. 4
Group T
Sub. PHY102
Set

DETERMINATION OF WAVELENGTH OF LASER LIGHT USING PLANE DIFFRACTION GRATING AND DETERMINATION OF GRATING ELEMENT OF GIVEN SPECIMEN

Apparatus Required

i) 3 diffraction gratings of different grating elements
ii) Laser source iii) Meter stick iv) Holding stands.

Theory

When the laser light coming from a laser source is allowed to fall normally on a diffraction grating diffraction patterns can be observed on the screen. If $(a+b)$ is the grating element, θ_n is diffraction angle for n^{th} diffraction maxima and λ be the wavelength of laser light.

$$(a+b)\sin\theta_n = n\lambda \quad \text{— (i)}$$

As shown in figure, y_n measured along meter stick from the central bright point to the n^{th} bright fringe related to θ_n

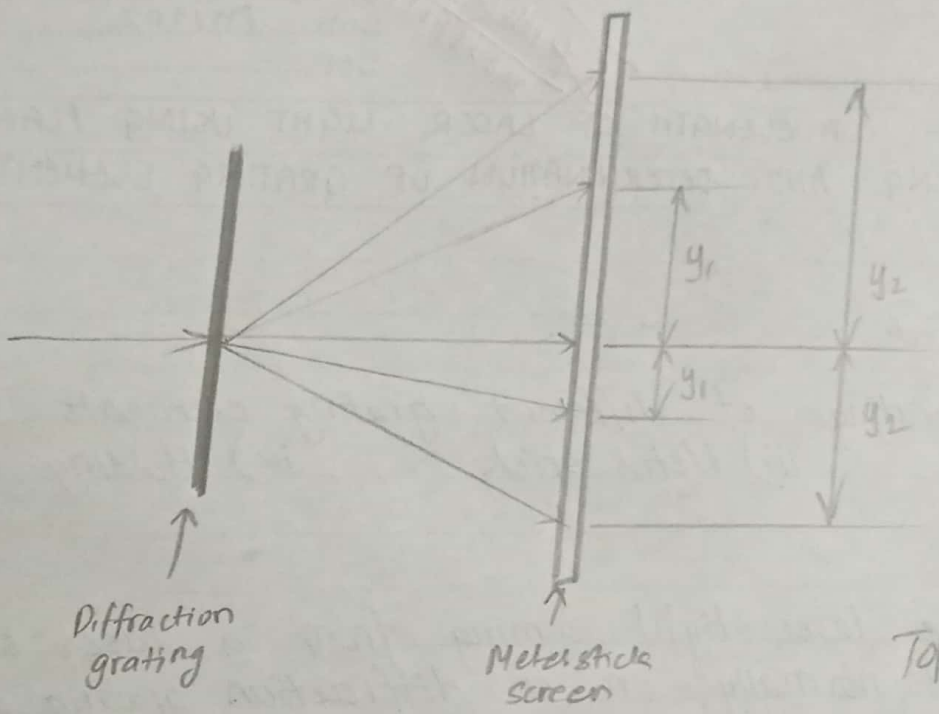
$$\sin\theta_n = \frac{y_n}{\sqrt{L^2+y_n^2}} \quad \text{— (ii)}$$

where,
L = distance between meter stick and diffraction grating
From (i) and (ii), we get.

$$\lambda = \frac{(a+b)}{n}\frac{y_n}{\sqrt{L^2+y_n^2}}, \quad n = 1, 2, 3, \ldots \quad \text{— (iii)}$$

Observation:

Least count of meter scale = 0.1 cm



Experiment setup for diffraction grating

Type of grating	Grating element	Order	Distance between grating and screen	Distance y_n			Wavelength
				Left	Right	Mean	
7500 lines/inch	3.39×10^{-4}	1		5.3	5.1	5.2	6.32×10^{-5} cm
2952.75 lines/cm		2	27.4	11.6	10.6	11.1	6.36×10^{-5} cm
		3		20.5	17.2	18.85	6.4×10^{-5} cm
2500 lines/inch	1.02×10^{-3}	1		1.8	1.7	1.75	6.5×10^{-5} cm
984 lines/cm		2	27.4	3.6	3.5	3.55	6.55×10^{-5} cm
		3		5.5	5.1	5.3	6.46×10^{-5} cm

Mean wavelength of laser light (λ) = 6.43×10^{-5} cm

Standard wavelength = 650nm = 6.5×10^{-5} cm

Error percentage = 1.077%

S.No.	Order	Distance	Distance from center			Grating element
			Left	Right	Mean	
1	1	115	55.7	56.5	56.1	1.46×10^{-4}
2	1	9.5	4.4	3.7	4.05	1.6×10^{-4}
3	1	15.1	7	6.5	6.75	1.57×10^{-4}

Mean value of grating element = 1.54×10^{-4} cm.

Conclusion:

The grating element is 1.54×10^{-4} cm.

2023/10/10