

SUBJECT – APPLIED PHYSICS (LAB)

EXPERIMENT –

OBJECT-: To determine the grating element of diffraction grating using laser beam.

APPARATUS REQUIRED-: Laser beam source, diffraction grating, optical bench, scale etc.

THEORY-:

Diffraction grating- A diffraction grating is periodic structure patterned into a reflecting surface which disperses light into its constituent wavelength.

Laser- Laser is a device which produce highly instance monochromatic and collimated light beam by stimulated emission process the acronym for laser is a light amplification by stimulated emission of radiation.

Grating element - It is the distance between two adjacent slit its value is obtained by dividing. The length of grating by total member of line ruled on the grating.

$$d = (L / N)$$

L = length of the grating.

N = number of line ruled on the grating.

USED FORMULA=

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

Where,

n = order of maxima

λ = wavelength of laser beam (6328A)

θ = angle

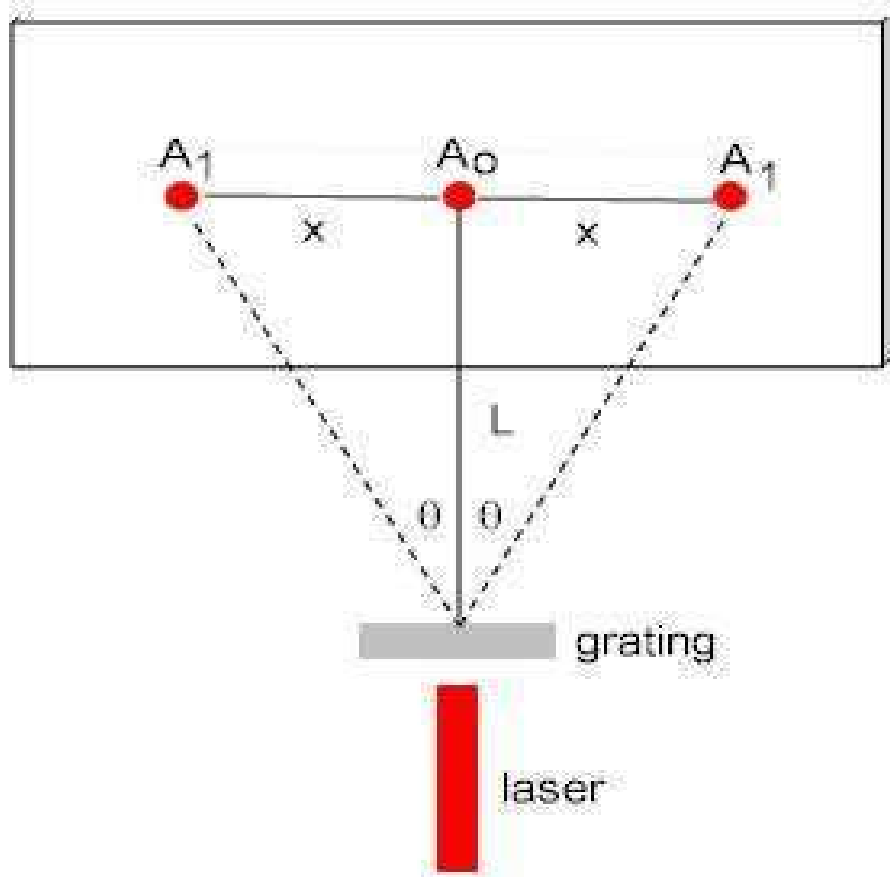


Figure = Experimental setup

Procedure:

1. Setup of Apparatus:

Mount the laser source on the optical bench and place the diffraction grating vertically in the path of the laser beam. Position a screen or measuring scale at a known distance from the grating to observe the diffraction pattern.

2. Alignment:

Switch on the laser and adjust the position of the grating so that the laser beam falls normally (perpendicularly) on the grating surface. A central bright spot (zero-order maximum) will appear on the screen.

3. Measurement of Distance:

Measure the distance D between the diffraction grating and the screen using a meter scale.

4. Observation of Diffraction Pattern:

Several bright spots will appear on both sides of the central maximum due to diffraction. These are the first-order, second-order, etc., maxima.

5. Measurement of Fringe Positions:

Measure the distance x between the central maximum and the first-order bright fringe on one

side of the screen. Repeat the measurement for the other side and take the average value to reduce error.

6. Calculation of Diffraction Angle:

Calculate the diffraction angle θ using the relation

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

7. Determination of Grating Element:

Using the diffraction grating equation

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

where n is the order of diffraction and λ is the wavelength of the laser, calculate the grating element d .

8. Repeat Observations:

Repeat the measurements for higher-order fringes (if clearly visible) and calculate the average value of the grating element.

OBSERVATION TABLE =

S. No.	Distance between the diffraction grating and the screen (D)	Order of maxima	Distance between the central maximum and the n th order bright fringe on one side of the screen			Angle $\theta = \tan^{-1} \left(\frac{x}{D} \right)$
			One Side (x ₁)	Other Side (x ₂)	Average (x) = (x ₁ + x ₂) / 2	
1.						
2.						
3.						

Calculation:

RESULT = After this experiment we get grating element (d) =

PRECAUTION =



Laser produces highly intense light so it is not to be seen directly.



Switch off the laser source as soon as experiment is completed.



Laser is not toys we use only for education purpose.