A Project Report

on

“Determination of Wavelength of Laser light using diffraction grating"

Submitted by

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Under the guidance

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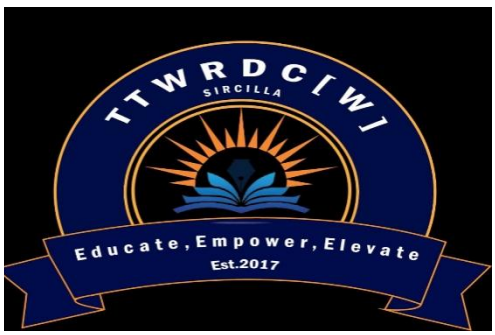

Department of Physics

Telangana Tribal Welfare Residential Degree College(W), Rajanna Sircilla.

(Affiliated to Satavahana University)

(Academic year -2021-22)

DECLARATION

I hereby declare that the project report titled " Determination of wavelength of Laser light using diffraction grating" have completed successfully towards the partial fulfillment for the award of the degree "BACHELOR OF PHYSICAL SCIENCE from "TELANGANA TRIBAL WELFARE RESIDENTIAL DEGREE COLLEGE FORWOMEN, RAJANNA SIRICILLA .This is the bonafide work undertaken by me which is not submitted to any other university or institution for the award of any degree / diploma.

Date: 24-2-2020

Place:Thangallapally

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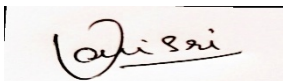
CERTIFICATE

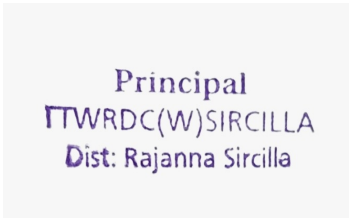
This is to certify that the project report title " Determination of Wavelength of Laser light using diffraction grating" submitted in partial fulfillment for the award of degree of B.Sc programme of department of Physics was carried out by Y.Vinika, G.Archana, B.Akhila.This has not been submitted to any other institute or university for the award of any degree.



Signature of the guide

K. Vanisri

Principal



Project report on determination of wavelength of Laser light using diffraction grating

Aim:

To determine wavelength of laser light using diffraction grating

Objective:

To Ensure accurate and precise measurements of the laser wavelength to minimize errors.

To verify experimental result with theoretical value of monochromatic laser beam (Visible light range verification)

Apparatus:

LASER source, Plane Transmission Grating, meter scale, Vertical stands, Screen, etc

Introduction:

Laser is a process by which we can obtain a beam of light which is highly coherent, highly monochromatic and perfectly parallel.

A laser beam can be sent to any place and return back without any practical loss of intensity and it can be used for many purposes.

The word diffraction is about spreading out of waves after passing through small opening. Diffraction effects are important when the size of the opening is comparable to or less than the wavelength

Principle:

According to grating equation, for a plane transmission grating

Sinθ=nNλ, Where θ - angle of diffraction,

So, λ = sinθ/nN

λ- the wavelength of Laser, n – order of spectrum and N – number of lines per unit length

Procedure:

1) A semi conductor diode laser is mounted on the vertical stand so that it produces a horizontal beam.

2) The given diffraction grating is placed on a vertical stand at a distance of about 6cm from the laser and

normal to it.

3) A screen is placed at a distance of L from the grating

4) When the power is switched on, laser beam is incident normally on the grating. The beam is diffracted at different angles and hence we get bright spots on the screen on either side of the central maximum.

5) The distances of these spots of different order from the central maximum is measured.

Tanθ can be calculated by the equation

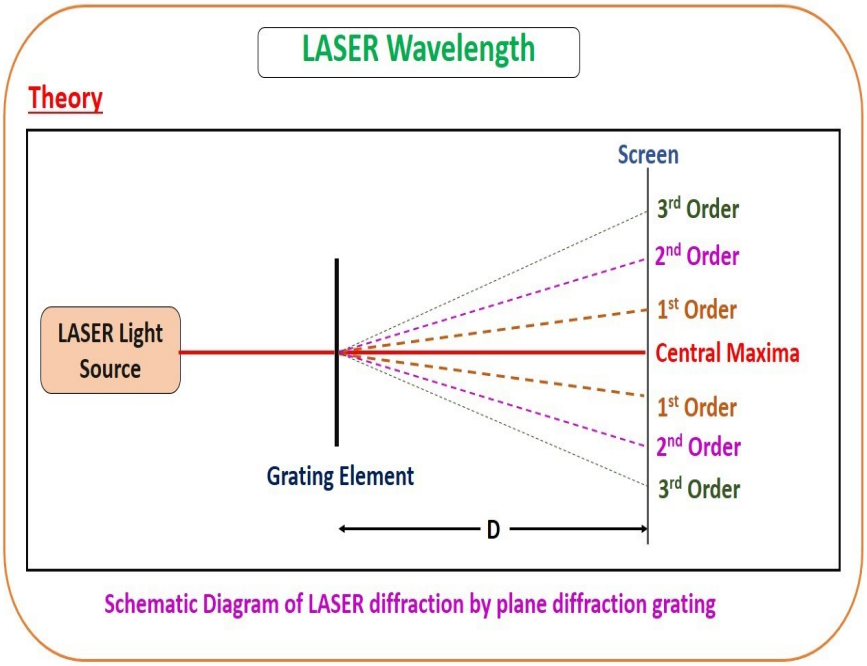
tan θ=X/L

From this θ is also calculated.

7) The wavelength of laser beam can be calculated using the formula

λ= sin θ/nN

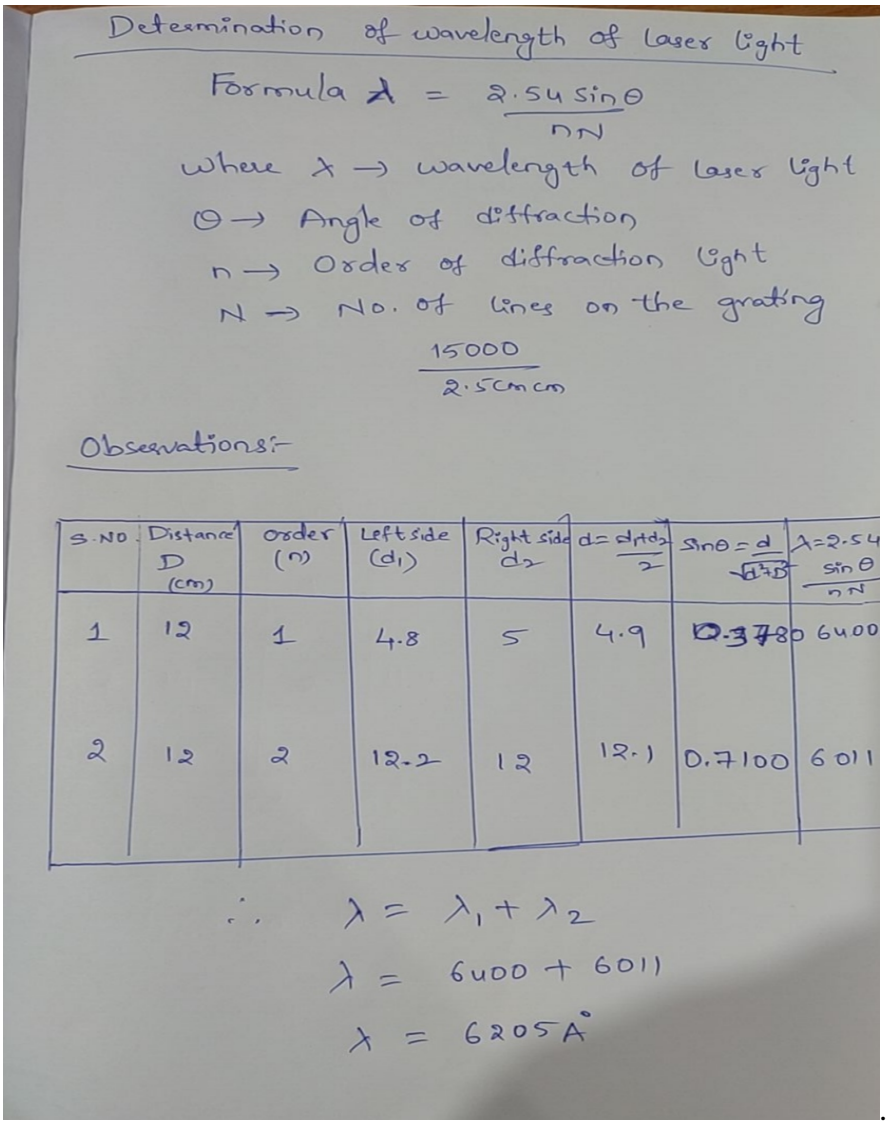
8) The experiment is repeated by changing the distance between grating and screen.



(Students observing the diffraction pattern and taking the observations)

Observations & Calculations:

Number of lines per inch on the grating, N = 15000 lines/ inch



Determination of wavelength of Laser light

Formula $\lambda = \frac{2.54 \sin\theta}{nN}$

where $\lambda \rightarrow$ wavelength of Laser light

$\theta \rightarrow$ Angle of diffraction

$n \rightarrow$ Order of diffraction light

$N \rightarrow$ No. of lines on the grating

$\frac{15000}{2.5 \text{ cm cm}}$

Observations:-

S.NO	Distance D (cm)	order (n)	Left side (d_1)	Right side d_2	$d = \frac{d_1+d_2}{2}$	$\sin\theta = \frac{d}{\sqrt{d^2+D^2}}$	$\lambda = 2.54 \frac{\sin\theta}{nN}$
1	12	1	4.8	5	4.9	0.3780	6400
2	12	2	12.2	12	12.1	0.7100	6011

$\therefore \quad \lambda = \lambda_1 + \lambda_2$

$\lambda = 6400 + 6011$

$\lambda = 6205 \text{ A}^\circ$

Result:

Experimentally calculated wavelength of laser light by taking multiple readings for different distances, We finally found the wavelength of laser light is 6205 A^0

Wavelength of LASER beam =6205 A^o