PHY F214 PHYSICS LAB-9 REPORT SEM-1 2017-2018

EXP NO. – 11 EXP NAME – Spectroscopy using diffraction grating

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AIM:

1. To calibrate the grating spectrometer using the known source (Hg source) of light and to calculate the grating constant.
2. Using the same grating,to calculate the wavelength of sodium doublet lines.

APPARATUS:

Spectrometer,transmission diffraction grating,sodium vapour lamp,mercury vapour lamp,power supply for spectral lamps , magnifying glass.

PRINCIPLE USED:

The diffraction grating is used for the precise study of the spectra .It is a set of identical and equally spaced slits separated by opaque strips.The diffraction occurs as a consequence of the propagation of waves around obstructions.When a wave front is incident on a grating surface ,lght is transmitted through slits and obstructed by opaque portions.The secondary waves from the positions of slit interfere with one another .

$D\sin(\theta)=\lambda$

OBSERVATION AND PROCEDURE:

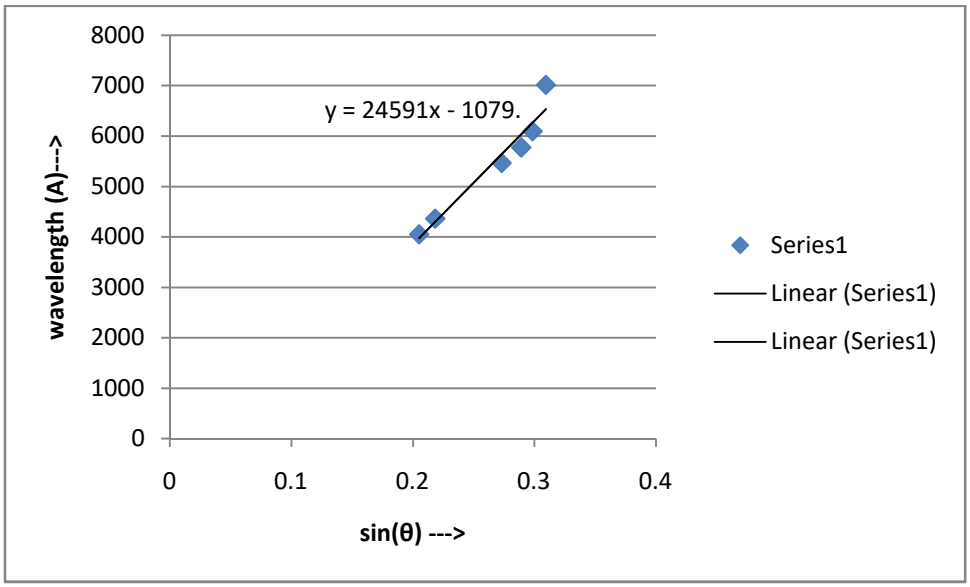
First of all we adjust the telescope for parallel rays.This is done by focussing the telescope on an object at infinity, or some very distant object.Then mount the grating for normal incidence and switch on the mercury lamp till it warms up completely.

With the mercury vapour source , observe the first order spectrum on one side

Rotate the telescope and note the angular position on both sides .Note the diffraction angle =(rhs –lhs)/2

TABLE OF sin(θ) and λ

	sinθ	λ (A^0)
Violet	0.2063	4047
Blue	0.2195	4358
Green	0.2742	5461
Yellow	0.2902	5770
orange	0.2995	6090
red	0.3105	7010



GRAPH OF λ vs sin(θ)

The slope of the graph of λ vs sin(θ) gives the grating constant which is equal to = 1/d as dsin(θ)=λ

The least count of the vernier scale is 1 minute as 0.5 degree corresponds to 30 divisions on vernier scale

The slope of the graph = d= 24591 A^0

The grating constant = 1/d = 4.0665×10^{-5} $(A^0)^{-1}$

We can see that the graph is a straight line

There is a difference in the left and the right side angles because of human errors and also because of the light not being perfectly perpendicular and there is also an error because of the backlash error that might occur while moving .There can also be human error while reading the vernier scale .

Next we use this grating constant to determine the wavelengths of sodium d1 and d2 lines

We let the sodium source to turn complete yellow and then note the angles of the d1 and d2 lines on both sides

Table for D1 and D2 lines

	θ (degrees)	Sin(θ)
D1	36.158	0.59001
D2	36.108	0.589309

λ for D1 line is λ=sin(θ) / grating constant = 14509.037 A^0

λ for D2 line is λ=sin(θ) / grating constant = 14491.798 A^0

INFERENCE:

We get to know that light shows wave nature and gets diffracted around the corners of objects comparable to the size of it's wavelength .

POSSIBLE ERRORS :

1. There can be human errors while taking the vernier readings .
2. There can also be error if the grating is not set for perfect normal incidence of light so there is a slight difference in the angles measured on the left and the right hand side.
3. There can also be error due to imperfectness of the sodium lamp also.