Date : 2020/12/31 Experiment No.: 1 Set :

PHY 1701 (Engineering Physics) Reg. No:- 20BDS0405

OBJECTIVE OF THE EXPERIMENT:

MONOCHROMATORS IN SOPHISTICATED INSTRUMENT

APPARATUS AVAILABLE:-

(i) Laser Source

(ii) Grating

(iii) Scale with measurements.

SLO:

To determine the wavelength of light produced by given laser source using transmission diffraction grating.

Suppose, D = the distance from the grating to the screen.

d = the spacing between every two lines (same thing as every two sources).

If there are 'N' lines per mm of the grating, then (d), the space between every two adjacent lines or (eviery two adjacent sources) is

$$d = \frac{1}{N}$$

The diffraction grating formula for the principal maxima is:-

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

where, n is the order of diffraction (= 1, 2, 3...) and θ is the angle of diffraction.

$$\lambda = \frac{\sin\theta}{Nn} \text{ (meter)}$$

OBSERVATION:

Number of lines per meter on grating is 10^5.

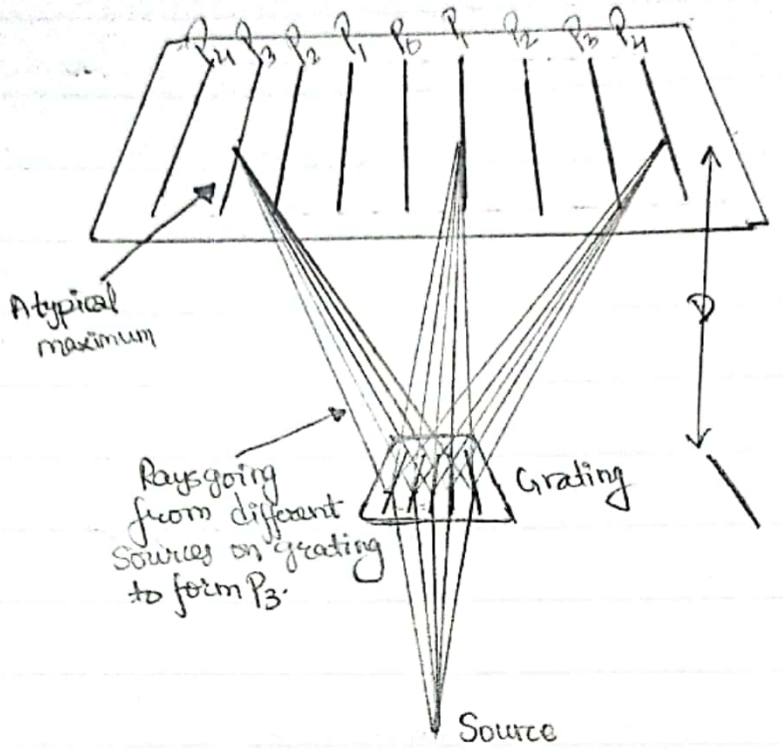

Fig:- Diffraction through a grating

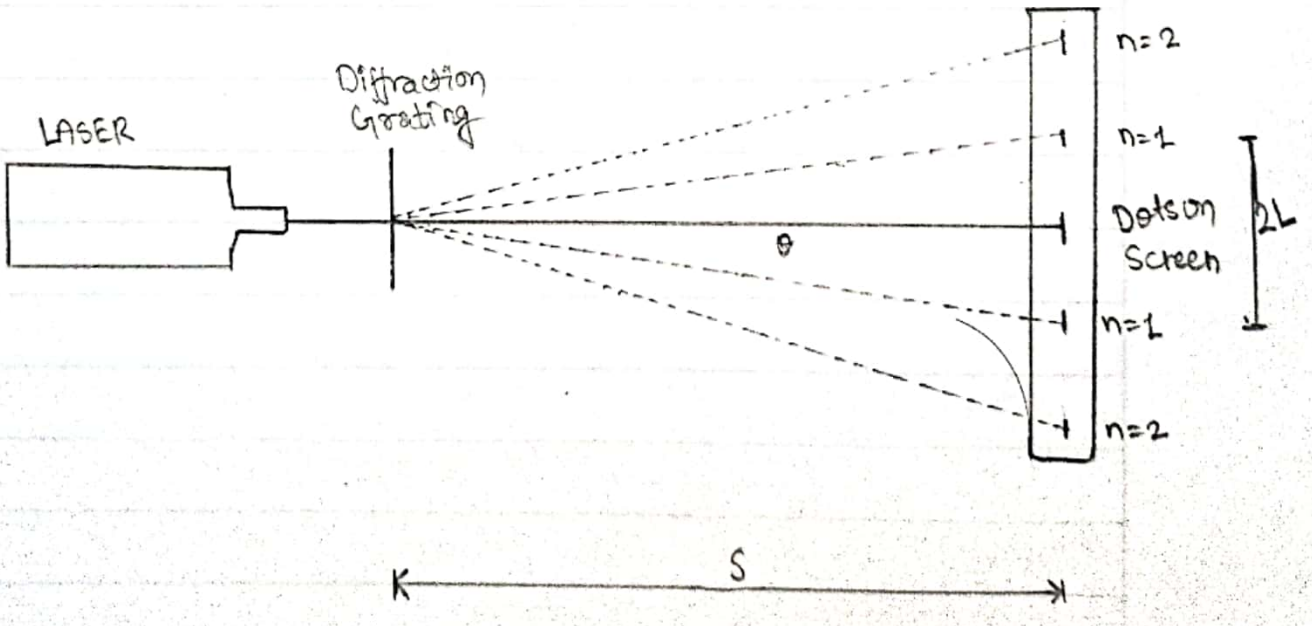

fig :- Experimental Setup.

n	S (cm)	2L (cm)	L (cm)	$\tan\theta = L/S$	$\theta = \tan^{-1}(L/S)$	$\sin\theta$	Mean	λ (nm)
1	25	3.3	1.65	0.066	3.7760°	0.0659	0.066	660
	30	4.0	2.00	0.067	3.8141°	0.0665		
	35	4.6	2.30	0.066	3.7597°	0.0656		
2	25	5.5	2.75	0.11	6.2773°	0.1093	0.1228	614
	30	7.8	3.9	0.13	7.4069°	0.1289		
	35	9.2	4.6	0.1314	7.4874°	0.1303		
3	25	9.9	4.95	0.198	11.1997°	0.1942	0.1959	653
	30	12	6	0.2	11.3099°	0.1961		
	35	14.1	7.05	0.2014	11.3886°	0.1975		

Sample Calculation:-

① $n=3$, $\sin\theta = 0.1959$ (mean value), $N = 10^5$ lines/m

$$\therefore \lambda = \frac{a\sin\theta}{n \cdot N} = \frac{0.1959}{10^5 \times 3} = 6.5311 \times 10^{-7}\ m$$

$$\approx 6531\ \text{Å}$$

$$= 653\ nm$$

Similarly, the calculations were carried out for 1st and 2nd order maxima and respective results are noted in the table.

Thus, Average wavelengths from three different orders of maxima is.

$$\lambda_{mean} = \frac{660 + 614 + 653}{3}$$

$$= 642\ nm$$

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RESULT:

The wavelength of the laser source is found to be 642 nm.