Monochromators in Sophisticated Instrument (Laser Grating)

Aim :
To determine the wavelength of the given laser source using transmission diffraction grating method.

Apparatus Used :
(i) Laser source
(ii) Grating
(iii) Scale with measurements

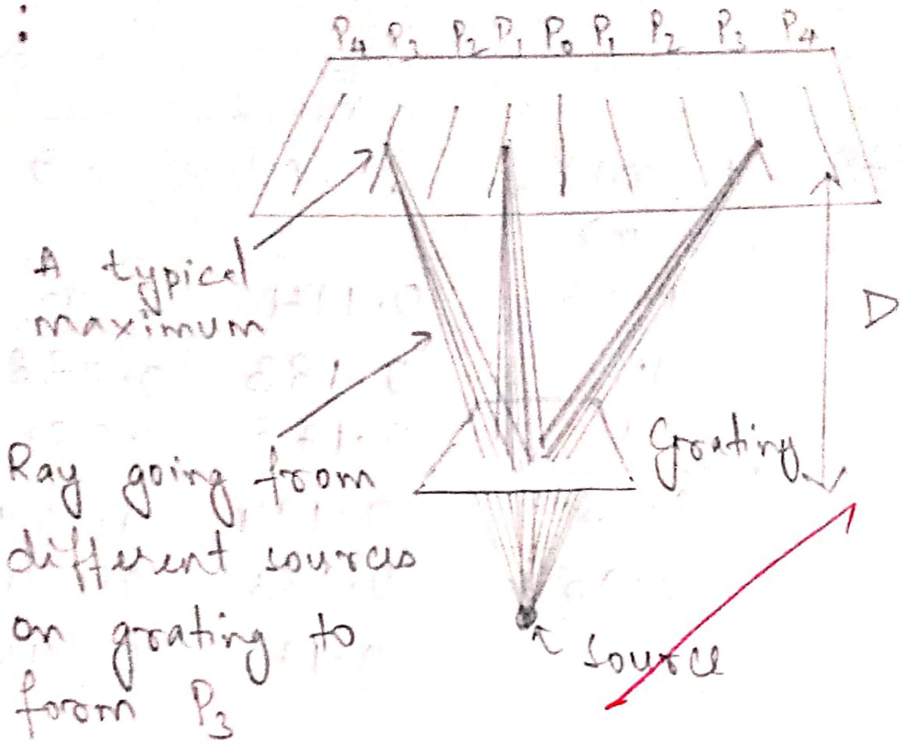
Table :

n	S (cm)	2L (cm)	L (cm)	$\tan\theta = \frac{L}{S}$	$\theta = \tan^{-1}\left(\frac{L}{S}\right)$	$\sin\theta$	Mean	λ (nm)
	25	3.6	1.8	0.072	4.11	0.0716		
1	30	4.1	2.25	0.075	4.28	0.074	0.069	690
	35	4.6	2.3	0.065	3.71	0.064		
	25	6.8	3.4	0.136	7.74	0.134		
2	30	7.9	3.95	0.131	7.46	0.129	0.130	650
	35	9.1	4.55	0.130	7.40	0.128		
	25	10	5.00	0.20	11.3	0.195		
3	30	11.9	5.95	0.198	11.19	0.194	0.195	650
	35	14.1	7.05	0.201	11.36	0.196		

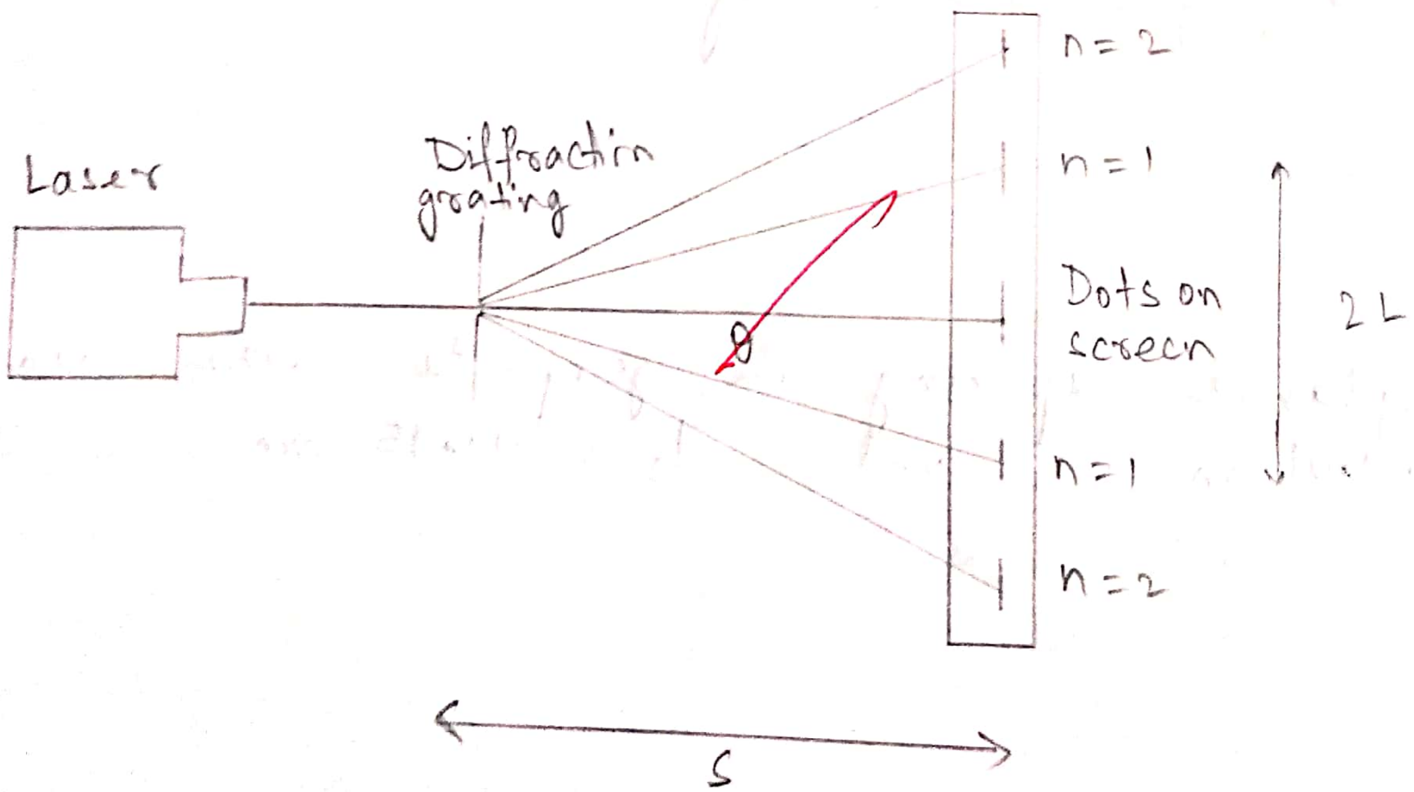
λ Mean: 663.33 nm

Teacher's Signature : ....

SKETCH :



EXPERIMENTAL SETUP :



Scanned by CamScanner

Process :

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 (every two adjacent lines 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 angle of diffraction

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

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Observation :
Number of lines per meter on the grating is 10^5 lines

Result :
The wavelength of the laser source is found to be 663.33 nm

Calculation :

$$\lambda_1 = \frac{\sin\theta}{Nn} = \frac{0.069}{10^5 \times 1} = 690\text{nm}$$

$$\lambda_2 = \frac{\sin\theta}{Nn} = \frac{0.130}{10^5 \times 2} = 650\text{nm}$$

$$\lambda_3 = \frac{\sin\theta}{Nn} = \frac{0.195}{10^5 \times 3} = 650\text{nm}$$

$$\lambda_{mean} = \frac{\lambda_1 + \lambda_2 + \lambda_3}{3} = \frac{690 + 650 + 650}{3} = 663.33\text{nm}$$