Meet Gala

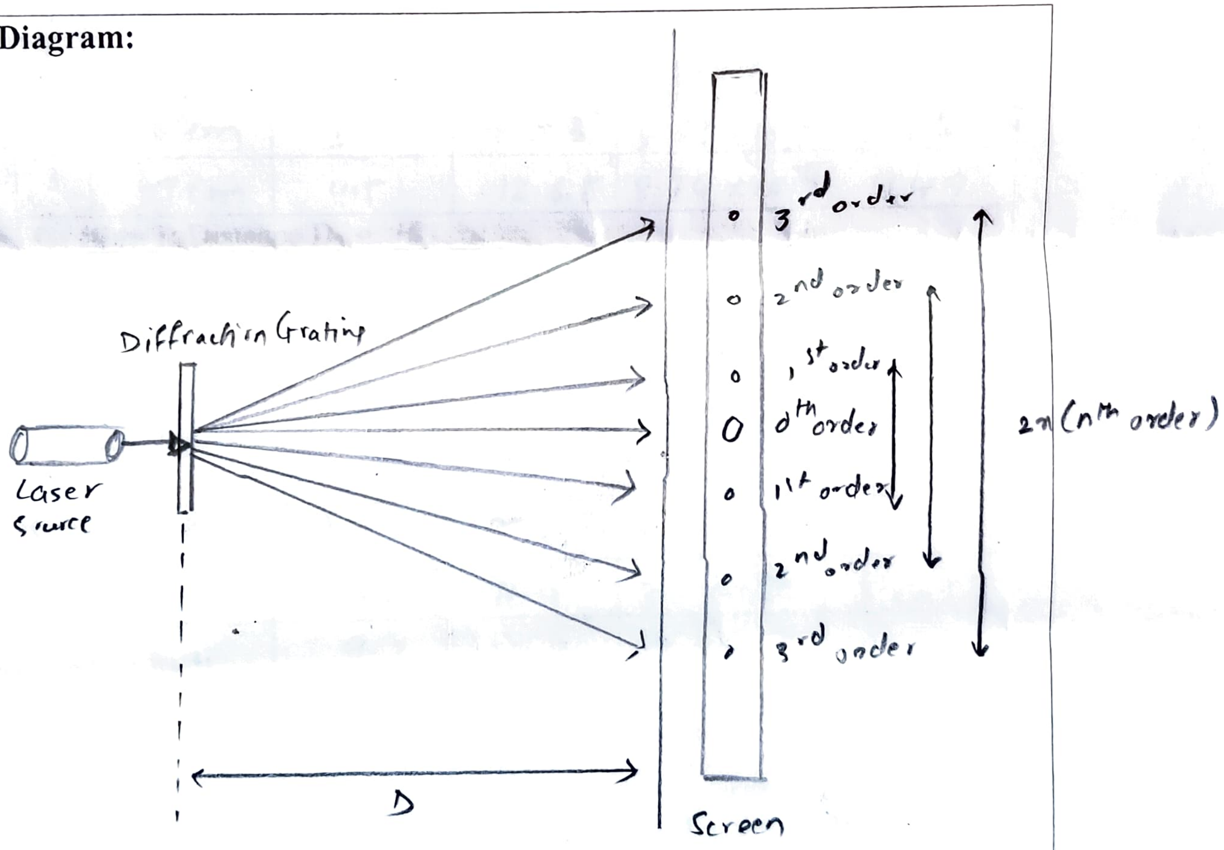
K. J. SOMAIYA COLLEGE OF ENGINEERING
(A Constituent college of Somaiya Vidyavihar University)

SOMAIYA
VIDYAVIHAR UNIVERSITY
K J Somaiya College of Engineering

Expt. No		Grating Constant		Date:	17/05/22
Batch:	A3	Roll No:	16010121051		
				(Marks & Signature of Faculty I/c)	

Aim:	To determine the number of lines per unit length of the given plane transmission diffraction gratings
Apparatus:	Different diffraction gratings, laser source, screen, metre scale

Diagram:



Procedure

1) Switch on the laser source so that a single bright spot (red) appears on the screen. Introduce given diffraction grating between the laser source and screen to obtain a diffraction pattern consisting of different intensity spots corresponding to different diffraction orders. Keep screen at around 50 cm from grating.

2) Measure distance ($2x$) between two first order spots ($n = 1$) on either sides of the central maximum. Hence, calculate average distance of the first order from the central maximum i.e. x. Repeat the same for higher orders.
3) Measure distance (D) between the grating and the central spot on the screen.
4) Calculate angle of diffraction (θ) for each order of grating. Repeat steps 2 and 3 for some other distance D.
5) Repeat steps 2 to 4 for other diffraction gratings.

Note:
Never point laser source or even its reflection from metal surfaces to anyone's eyes – intentionally or un-intentionally.

Observations:

Grating 1: Distance D_1 = 20 cm

n	$2x$ (cm)	x (cm)	θ	(a + b) (cm)	#N (cm^{-1})
1	3cm	1.5	4.28°	8.51×10^{-4}	1176
2	6 cm	3	8.53'	8.63×10^{-4}	1162
3	9cm	4.5	12.68'	8.74×10^{-4}	1149
Grating 1: Distance D_2 = 16cm					
1	2.8	1.4	5.00	7.34×10^{-4}	1369
2	4.7	2.35	8.35'	8.82×10^{-4}	1136
3	7	3.5	12.33'	9×10^{-4}	1111
Grating 2: Distance D_1 = 20 cm					
1	8.5	4.25	11.9	3.1×10^{-4}	3225
2	18.4	9.2	24.7	3×10^{-4}	3333
3	30	15	36.8	3.2×10^{-4}	3125
Grating 2: Distance D_2 = 16cm					
1	7	3.5	12.33'	3×10^{-4}	3333
2	14.5	7.25	24.32'	3.7×10^{-4}	2702
3	22.5	11.25	35.11'	3.3×10^{-4}	3030

#Round-off to nearest integer

Formulae:	Symbols:
$\theta = \tan^{-1}\frac{x}{D}$	θ = Angle of diffraction
$a+b = \frac{n\lambda}{\sin\theta}$	x = Average distance of n^{th} order spot from central spot
$N = \frac{1}{a+b}$	D = distance between screen and grating [a+b: Grating element]
	n : order of diffraction max
	λ : Wavelength of incident light
	N: Number of lines/cm of the grating

Data:

Wavelength of light from laser source λ	6400 A°

Calculations:

$\theta = \tan^{-1}\left(\frac{1.5}{20}\right) = 4.28°$

$a+b = \frac{n\lambda}{\sin\theta} = \frac{1 \times 6400}{\sin(4.28)} = 8.58 \times 10^{-4}$

$\frac{1}{a+b} = \frac{1}{8.58 \times 10^{-4}} = 1176$

Results:

Average N for Grating 1: 1183.5

Average N for Grating 2: 3124.66

Further Work:

Use of lasers in atomic and nuclear physics