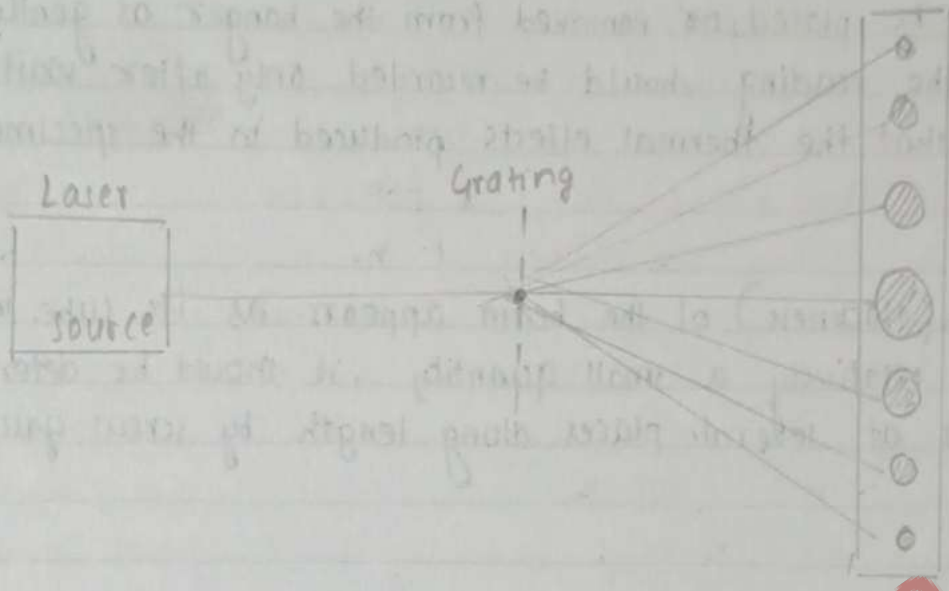

a) No. of lines on the grating N

Grating element $(a+b) = \frac{2.54}{N}$

formula used :-

x_1 = distance on one side

x_2 = distance on other side

r = distance b/w centre of central bright maxima and centre of diffraction grating

θ_n = Angle of diffraction of n^{th} order maxima

$$\theta_1 = \frac{x}{r} \qquad \left[x = \frac{x_1 + x_2}{2}\right]$$

$$\lambda = (a+b) \sin\theta_1$$

AIM: To determine the wavelength of laser light by using transmission diffraction grating

APPARATUS: A He-Ne laser source, a transmission diffraction grating, a grating stand, screen, measuring tape and a mm scale.

THEORY: When a parallel beam of monochromatic light is incident normally on a grating, the transmitted light gives rise to primary maxima in curtain directions given by the relation

$$(a+b)\sin\theta_n = n\lambda$$

where a is the width of a transparency,
b is the opacity
θ_n is the angle of diffraction for n^{th} order maxima
λ the wavelength of light.

for 1st order spectrum : $(a+b)\sin\theta_1 = \lambda_1$
for 2nd order spectrum : $(a+b)\sin\theta_2 = \lambda_2$

PROCEDURE:

1. Place the He-Ne laser source at one end of the table. Take out the grating carefully from the box, holding it from the edge and without touching it surface mount the grating on its stand at a suitable distance so that laser light normally falls on it.

$\frac{1}{(a+b)}$	x_1	x_2	x	γ	θ_1	$A^\circ(\lambda)$
600 mm	7	6.8	6.9	14.9	26.54	7447
300 mm	6.2	6.2	6.2	30.5	11.63	6766
100 mm	1.8	1.6	1.7	25.3	3.14	5477

$$\lambda_{mean} = \frac{\lambda_1 + \lambda_2 + \lambda_3}{3}$$

$$= \frac{7447 + 6766 + 5477}{3}$$

$$= 6563\ A^\circ$$

2. Place a screen behind the grating at a suitable distance so that light beam after passing through the grating procedures several bright spot on the screen. Adjust the position so the diffraction spots are sharp and bright.

3. The brightest spot is the central maxima and symmetrically situated on both side of central maxima there are several bright spots of diminished intensity.

4. The second brightest spot on either side of central maxima is the second order spectrum.

5. measure the distance of centre of central bright spot on the screen from the centre of grating.

RESULT: Wavelength of laser light = 6563 A°

PRECAUTIONS:

1. The laser tube axis should be horizontal.

2. The light should fall on whole of the grating surface.

3. The grating should be held from the edge and then ruled surface should not be touched.

4. The laser source should be switched on while taking the observation and switched off immediately thereafter.