

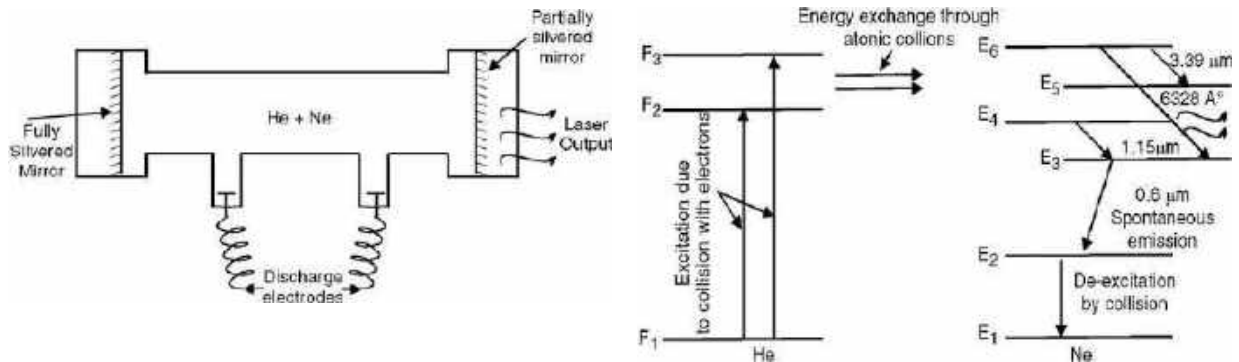
**SUBJECT – APPLIED PHYSICS (LAB)**

**EXPERIMENT–**

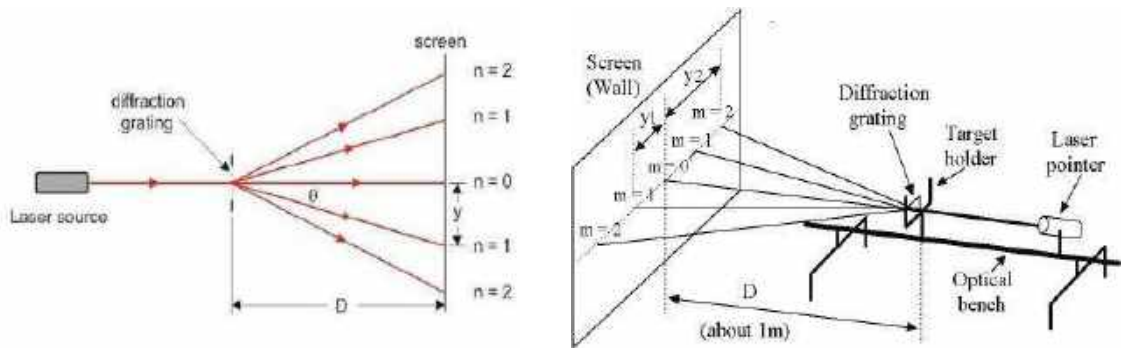
**OBJECT**-Determination of angular divergence of LASER beam.

**APPARATUSREQUIRED** – Helium Neon laser source, Optical bench, Screen, meter scale, diffraction grating.

**DIAGRAM -**



**Fig – Diagram of helium neon laser Fig – Working of helium neon laser**



**Fig – diffraction grating of laser**

**THEORY**– First of all critical population inversion is to be achieved. The best way is by excitation of extra active species of the laser medium to upper level. For continuous operation of laser, both population of lower level are important. If there is accumulation of too many species in the lower level, it may drastically reduce the population inversion and stop the laser action. The process by which the desired population inversion is achieved is called pumping. In case of He-Ne laser electrical pumping is employed.

- **Divergence of laser beam**–The light emitted by a laser is confined to a rather narrow core. But when the beam propagates outward it slowly diverges or fans out. For an

electromagnetic beam, beam divergence is the angular measurement of the increase in the radius or diameter with distance from the optical aperture as the beam emerges.

- Beam spot size–Beam diameter is defined as the distance across the centre of the beam for which the irradiance equals  $1/e^2$  upon of the maximum irradiance. The spot size of the beam if the radial distance from the centre of maximum irradiance to the  $1/e^2$  point.
- Beam divergence - The Beam divergence of an electromagnetic beam is an angular measure of the increase in beam diameter with distance from the optical aperture from which the electromagnetic beam emerges. It is given by

$$\theta = (w_2 - w_1)/d$$

Where,  $w_1$  and  $w_2$  are the beam spot size of a laser beam mounted at two points separated by a distance  $d$ . Angular divergence  $\theta$  is given by

$$\theta = d/D$$

Where,  $d$  = diameter of spread

$D$  = distance between grating and screen

**OBSERVATION** –

S. No.	Distance from grating to screen (D) (in cm)	Linear spread (d) (in cm)			Angular Spread [ $\theta=d/D$ ]
		Along one direction	Along the Perpendicular direction	Mean “d”	
1.					
2.					
3.					

Mean  $\theta$  = \_\_\_\_\_ radian

**RESULT** – Angular spread of laser light = \_\_\_\_\_ degree

**PRECAUTIONS** – 1. Never look directly into any laser beam.

2. Note all the readings carefully.

3. All instruments should be set carefully before using.