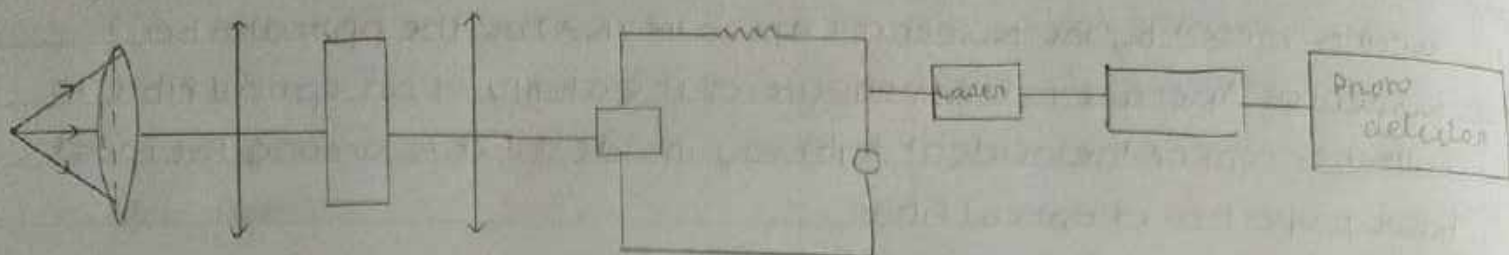


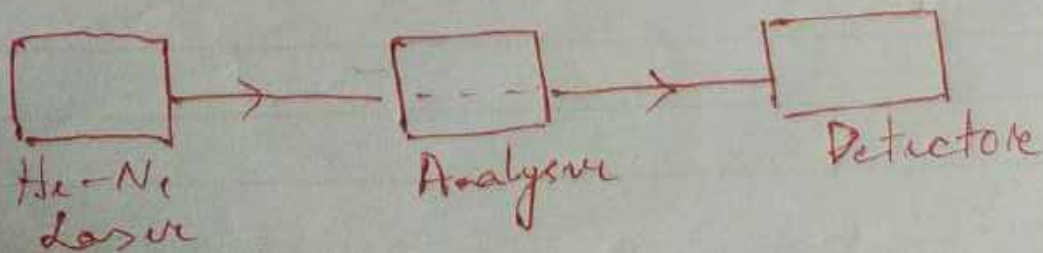
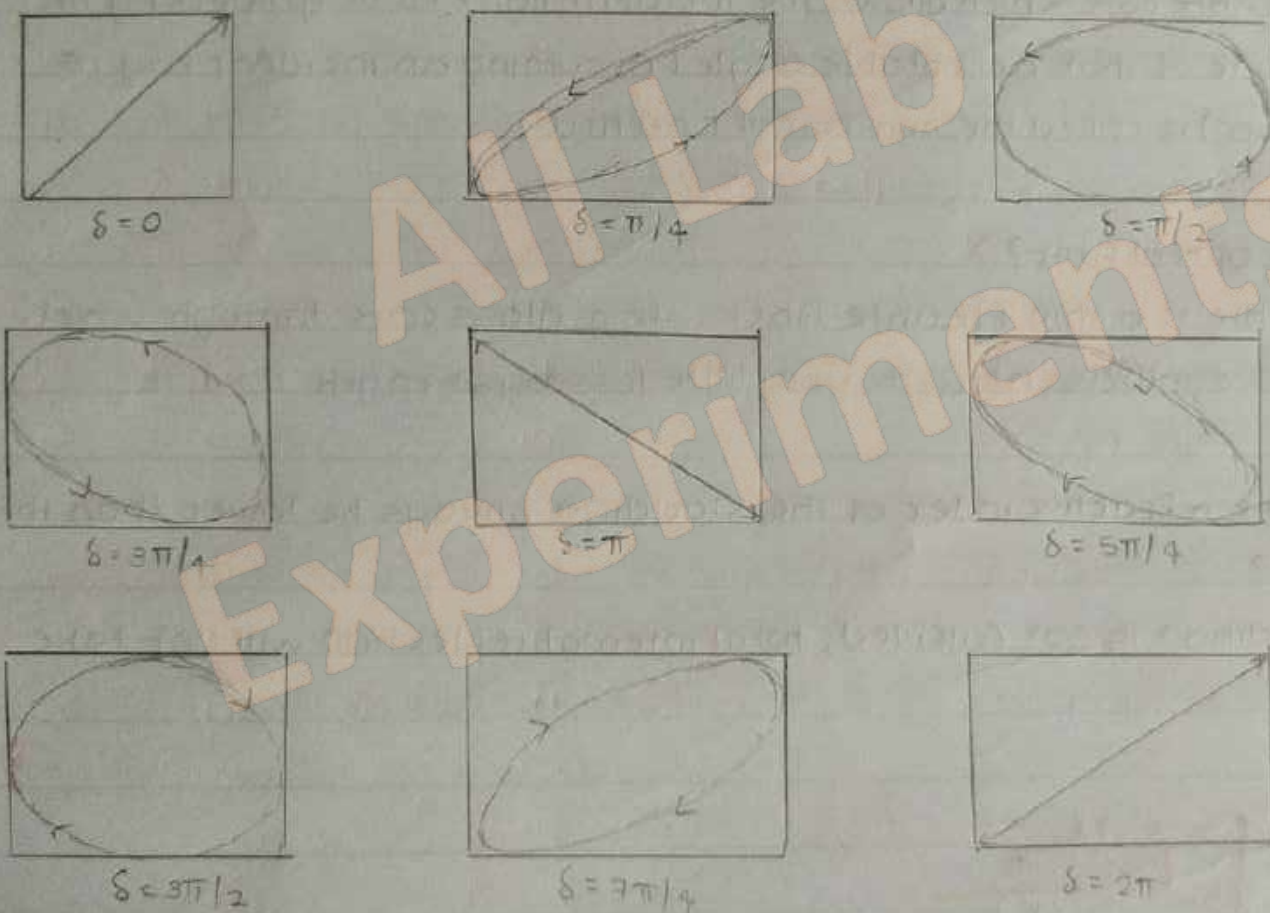
Aim: To find out the state of polarization of He-Ne Laser

Diagram



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Setup to study the variation of I & θ :



Aim: To find out the state of polarization of a He-Ne Laser.

Apparatus Required: He-Ne laser, analyser, intensity detector, a glass plate with a holder which can be rotated in its own plane through a known angle.

Theory:

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Polarization: The phenomenon of confining the vibrations in ordinary light to one single plane is called polarization. It can be achieved through reflection, double refraction, selective absorption, etc.

States of polarization: There are three types of polarization that are used to describe light.

→ Linear Polarization: If the polarization of all the electromagnetic waves in a light beam can be made so that each of the electric or magnetic vector have the same ~~variation~~ orientation, then the light beam is said to be polarized. Because of this, there is then a unique plane which contains all the directions of the electric/magnetic field along with the light ray.

→ Circular Polarization: It can be described as the vectors of the electric field are rotated at a point in space in the direction that is perpendicular to the plane of propagation, instead of fixed orientation oscillation. If the electric field vector of the light appears to be rotated in a clockwise direction, then the wave is right circularly polarized. On the other hand, if the light vector appears to rotate in a counterclockwise direction, then the wave is said to be left circularly polarized.

Observation

S _{No}	Angle (Degrees)	Intensity (Lux)
1	0	98
2	10	103
3	20	101
4	30	96
5	40	85
6	50	70
7	60	52
8	70	36
9	80	19
10	90	7
11	100	0
12	110	0
13	120	7
14	130	17
15	140	34
16	150	49
17	160	67
18	170	80
19	180	90
20	190	91
21	200	100
22	210	92
23	220	79
24	230	65
25	240	57
26	250	37
27	260	18
28	270	6

S _{No}	Angle	Intensity (Lux)
29	280	0
30	290	0
31	300	6
32	310	22
33	320	39
34	330	52
35	340	75
36	350	88
37	360	98

Degree of polarisation

$$P = \frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{103 - 0}{103 + 0} = 1$$

∴ P = 100%

→ Elliptical Polarization: It consists of two light waves that are linearly polarized and having unequal amplitudes but having same frequency. This results in a light wave with electric vectors that both rotate and changes its magnitude. An elliptical electrical field vector, and hence is called elliptical polarization.

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He-Ne Laser: The He-Ne Laser is the first gas laser. It is widely used in interferometry, laser printing, bar code reading, as pointing and directional reference beam, for measurement of optical fibre line, etc.

State of polarization in a He-Ne Laser: The state of polarization is linear, making these lasers ideal for polarization-sensitive applications.

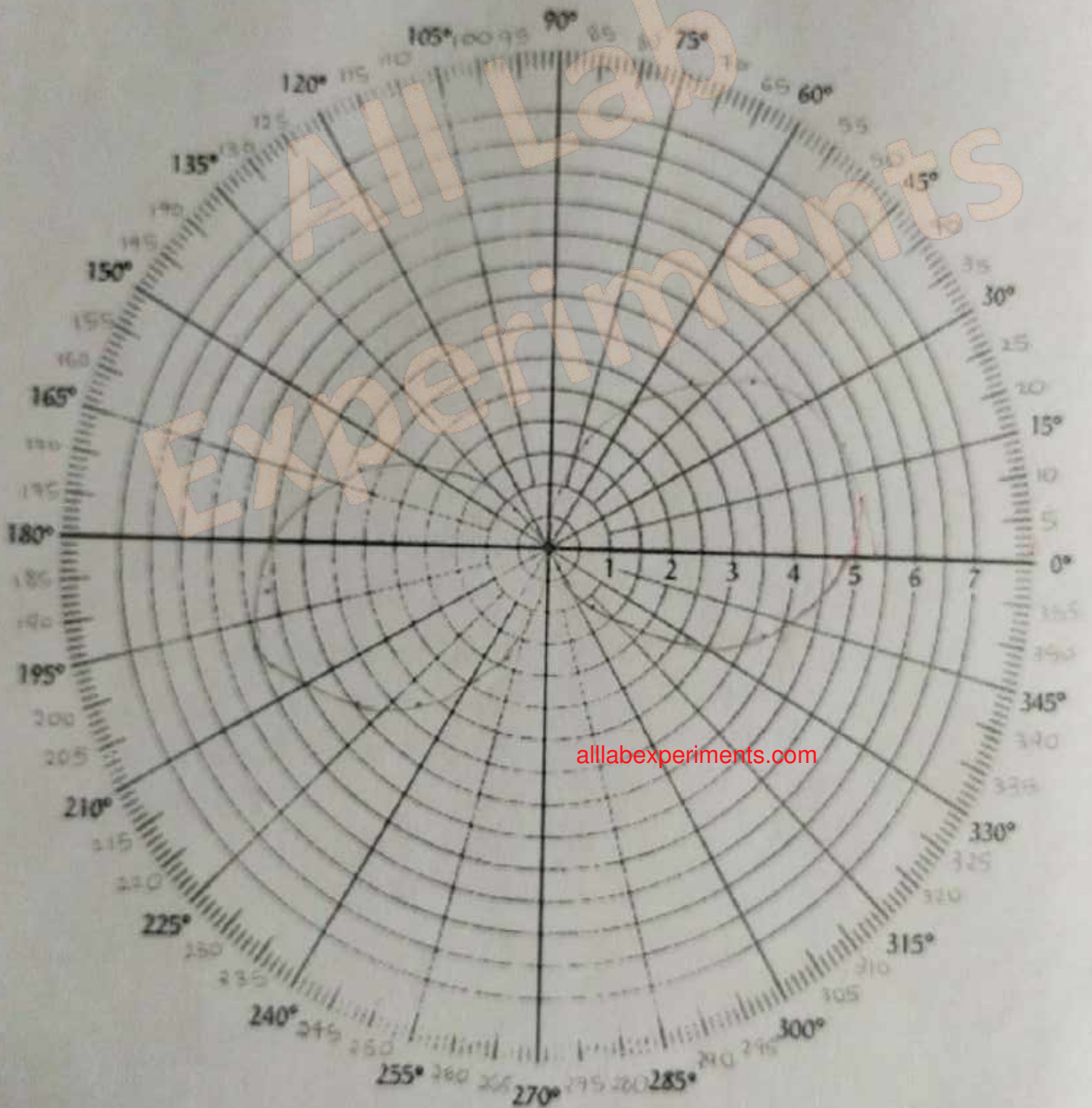
Precautions & Sources of Errors:

1. The laser beam should not be seen with direct eyes for a longer time as it may produce burn in the cornea due to prolonged exposure.
2. The angle should be changed in the steps of 10° .
3. While changing the angle, the backlash error should be avoided.

The degree of polarisation is 100%. Hence
Result: The ~~He-Ne~~ He-Ne Laser is found to be linearly polarized.

Polarization Graph

Scale: r 1 unit = 10 lux units
 θ 1 unit = 5 degree



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