

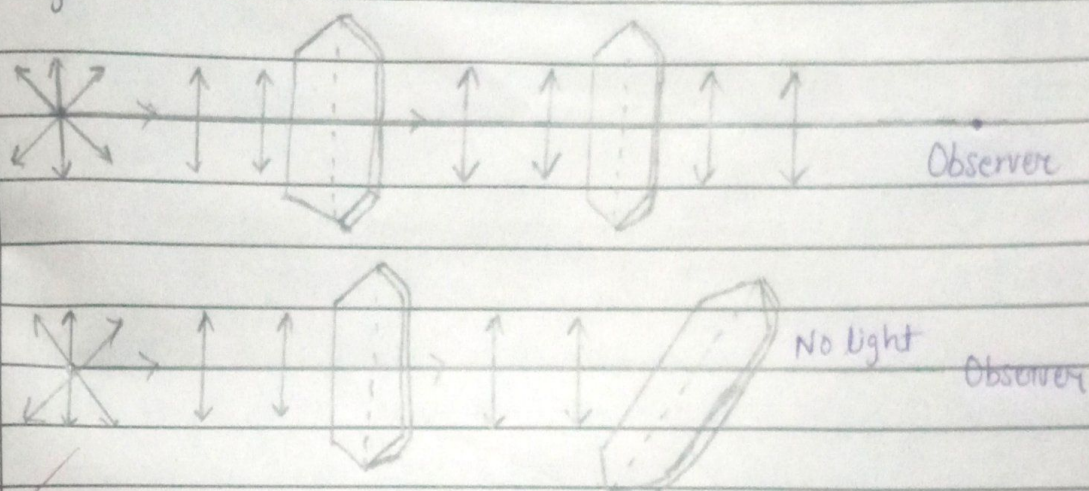
PRACTICAL - 8

Study of Polarization (Virtual)

Aim: To study polarization of light using He-Ne Laser

Apparatus: He-Ne Laser, Polarizer, Analyzer, Photodetector, Protractor, Rotating mounts for polarizer and analyzer.

Diagram:



Formula

↳ According to Malu's Law, the intensity of light after passing through two polarizers (polarizer and analyzer) is given by:

$$I = I_0 \cos^2 \theta$$

where,

- I_0 is the initial intensity of the light before it passes through the polarizer. θ is the angle b/w the transmission axes of the polarizer and analyzer.

- I is the transmitted intensity after passing through the polarizer and analyzer.



Observation Table

Angle of pol- arizer(deg) ϕ	Angle of analyzer (deg) θ	Angle b/w the axes of polarizer and analyzer $\theta = \phi - \phi_0$	$\cos \theta$	$\cos^2 \theta$	I_{out}/I_{in}
0	0	0	1	1	1
0	20	20	0.93	0.88	0.166
0	40	40	0.76	0.58	0.444
0	60	60	0.5	0.25	0.907
0	80	80	0.17	0.03	0.0121
0	100	100	-0.17	0.03	0.74
0	120	120	-0.5	0.25	0.662
0	140	140	-0.76	0.58	0.039
0	160	160	-0.93	0.88	0.951
0	180	180	-1	1	0.358

Observation from graph

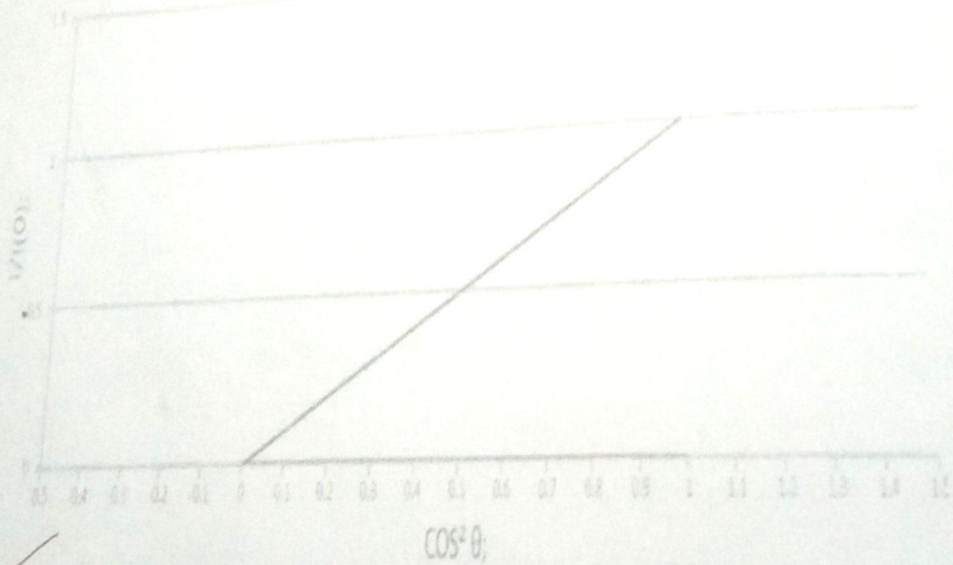
1. The graph of $\cos^2(\theta)$ vs the ratio of output intensity to input intensity is linear with a slope of 1.

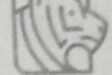
Conclusion

1. A quantitative demonstration of the polarization of light and the behaviour of light as it passes through polarizing filters is verified.
2. The intensity of polarized light follows Malus' Law.

Procedure

Start the virtual lab simulation using the link below and connect all the connections given in the diagram.
Enter the value of angle of polarization in the box given below polarizer.





3. Enter the value of angle of ~~polarization~~ analyzer in the box given below analyzer.
4. Note the value of Ratio of output intensity to input intensity of the laser light.
5. Enter the ~~age~~ value of analyzer, angle of Polarizer and ratio of output to input intensity.
- ✓ Repeat the observation to complete the observation table.
- Click the "Plot Graph" button.
- Calculate the slope of the graph.

Theory

Whenever ordinary light or unpolarized light (transverse Electromagnetic wave in which vibration of Electric vectors are perpendicular to the plane of propagation in all possible directions) passes through any polarizer it gets polarized. This polarized light passes through any analyzer.

The intensity of light after passing through two polarizers (a polarizer and an analyzer) depends on the angle b/w the polarizing axes of the two filters. The relationship is given by Malus's Law which states:

$$I = I_0 \cos^2 \theta$$

where,

I_0 = Initial intensity of the light

θ = angle b/w polarizer and analyzer

I = Output intensity of light

The ratio of output intensity

$$\boxed{\frac{I_{out}}{I_{in}} = \cos^2 \theta}$$

C
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