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Expt. Name Michelson's Interferometer Page No. 10

Experiment-4

Aim:

To determine the refractive index of a thin glass plate.

Apparatus:

Laser light source, Michelson Interferometer Kit, optical bench, glass plate, meter scale.
Online Lab Simulator.

Theory:

Consider a glass plate of thin thickness t and refractive index n, inserted normal to the path of one of the two interfering beams in Michelson Interferometer. The optical path length of the beam through the plate is nt, while the optical path length through an equal thickness of air is just t, so the increase in optical path length caused by inserting the plate is $(n-1)t$.

The beam traverses the plate twice, so the total path difference will be $2(n-1)t$. If N is the no. of fringes, $\theta = 30°$,

$$\eta = \frac{(2t - N\lambda)(1 - \cos\theta)}{2t(1 - \cos\theta) - N\lambda}$$

Teacher's Signature:

S.NO.	fringe Shifted (N)	Angle of rotation (θ)
1	1	0.36°
2	2	1.71°
3	3	2.39°
4	4	2.93°
5	5	3.37°
6	6	3.76°
7	7	4.11°
8	8	4.44°

SNO.	fringe shifted (N)	Angle of Rotation (θ°)
1	1	0.39°
2	2	1.68°
3	3	2.35°
4	4	2.86°
5	5	3.3°
6	6	3.68°
7	7	4.03°
8	8	4.35°

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Procedure :

1) Switch ON the laser source using Power on button.
2) Blurred Image fringe pattern will appear on the screen, shown in the zoomed view at the upper right corner of the simulator. Make the fringes sharp using the slider Adjust mirror.
3) To find the refractive index of a glass plate, insert the glass plate in the laser beam.
4) Change the angle of incidence of light on the glass plate. Note the no. of fringes displaced. The refractive index n of the glass plate can be calculated from the equation.
5) Thickness t of the glass plate can be changed.
6) The Reset button resets the whole experimental arrangement to its default configuration.

Result :

Refractive index of the given glass plate is 1.5 .

Teacher's Signature:

Calculations:

- for Krypton laser,

$\lambda = 5680\,\text{Å}$, $t = 2\,\text{mm}$.

$$\eta = \frac{(2xt - N\lambda)(1-\cos\theta)}{2t(1-\cos\theta) - N\lambda}$$

$$= \frac{(2\times 2 - 2\times 5680)(1-\cos(1.71))}{2\times 2(1-\cos(1.71)) - 2\times 5680}$$

$$\approx 1.5$$

- for He-Ne laser,

$\lambda = 5430\,\text{Å}$, $t = 2\,\text{mm}$

$$\eta = \frac{(2\times 2 - 4\times 5430)(1-\cos(2.86^\circ))}{2\times 2(1-\cos(2.86^\circ)) - 4\times 5430}$$

$$\approx 1.5$$