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EXPERIMENT No. : 4

AIM

To determine Brewster's angle for glass using a polarised light source.

APPARATUS USED

Laser, Polariser, Glass plate, Plate holder, Rotational mount, Detector, Current Output unit.

THEORY AND FORMULA USED

When light travels from one media to another having different refractive index, some of the light is reflected back from the surface of the denser medium. This reflected ray's intensity changes with change in the angle of incidence at the inferface of two media. At one specific angle of incidence of light only perpendicular vibrations of electric field vectors are reflected whereas parallel vibrations are blocked. The angle of incidence for which reflected ray is polarised is called the polarisation angle (θ_p) or Brewster's angle.

Brewster's angle for a given medium is

$$\mu = \tan \theta_p$$

$$\theta_p = \tan^{-1} \mu$$

where 'μ' is refractive index of medium and 'θ_p' the polarisation angle.

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PROCEDURE (virtual)

- Select the medium (air), material (crown glass) and click the switch On light.
- Rotate the glass plate at an interval of 5°, move down the rotation angle (θ) and corresponding current value (I).
- Plot a graph of reflected power (current I) v/s angle θ.
- From the graph find Brewster's angle as well as refractive index of the material.

OBSERVATION TABLE

Rotation Angle θ	40	45	50	55	60	65	70	75	80	85
Current (I)	5.603	3.607	1.938	1.061	1.245	2.432	4.267	6.265	8.020	9.321

RESULT

Reflected Power (current I) v/s angle θ graph is plotted.

1. Brewester's angle for the material (crown glass) is 56.2°
2. The Refractive index of the material (crown glass) is

$$\tan(56.2^\circ) = 1.49$$

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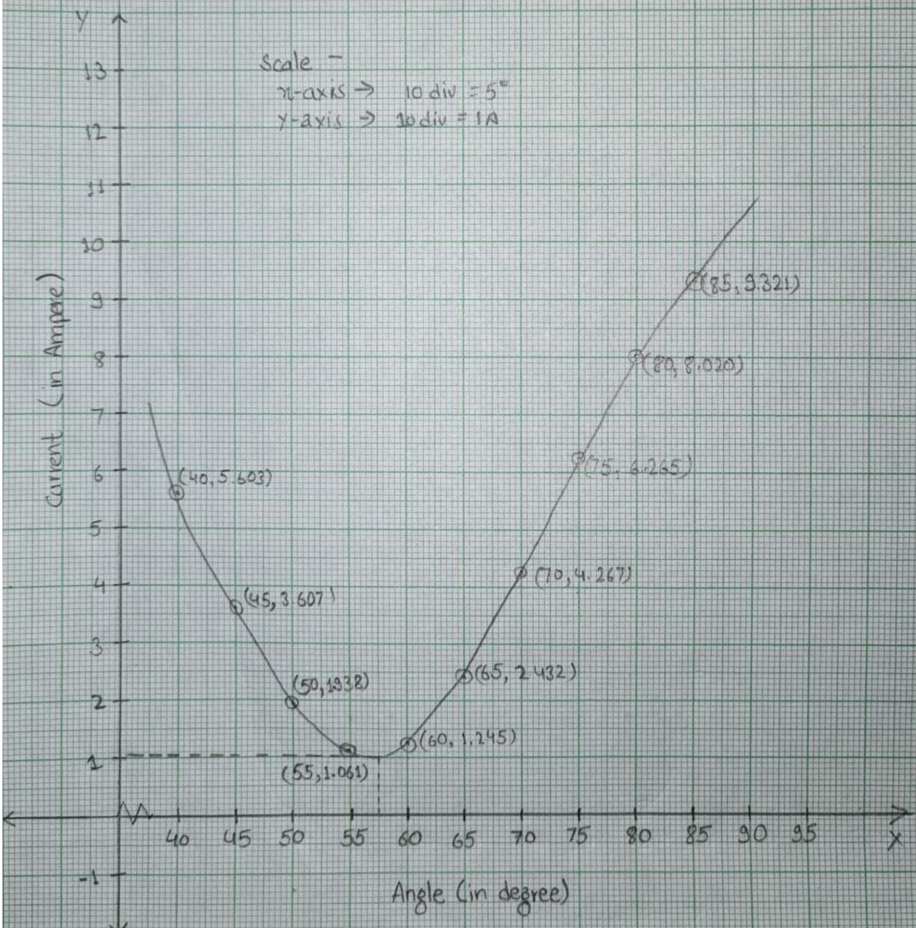
• GRAPHICAL ANALYSIS



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EXPERIMENT No. : 5

AIM

To determine the relationship between the intensity of the transmitted light through analyser and the angle between the area of polariser and analyser.

APPARATUS USED

Loser, polariser, Analyser, Photo detector, ~~Dect~~ Detector output measuring unit, optical bench.

THEORY AND FORMULA USED

When light falls on a polariser, the transmitted light gets polarised. The polarised light falling on another polariod, called analyser is given by Malus' law. The law describes how the intensity of light transmitted by the analyser varies with the angle that its plane of transmission makes with that of the polariser. The law can be mathematically written as

$$I_t = I_o \cos^2\theta$$

Where I_t is the intensity of the light transmitted through the analyser and I_o is the intensity of the incident plane polarised light.

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PROCEDURE (virtual)

- Click the power on knob
- Rotate the polarizer angle at an interval of 10 degree, not down the rotation angle (Θ) and corresponding current value (I_{expt})
- Plot a graph between I_{expt} V/S Θ

Observation table

S. No.	Angle of polarizer Θ (Here it is polariser degrees)	$\cos\theta$	$\cos^2\theta$	Current I_{exp} (mA)	Current $I_{th} = I_{max} \times \cos^2\theta$
1.	0	1	1	10.0	10.0
2.	30	0.866	0.75	7.50	7.5
3	60	0.5	0.25	2.50	2.5
4.	90	0	0	0.0	0
5.	120	-0.5	0.25	2.50	2.5
6.	150	-0.866	0.75	7.50	7.5
7.	180	-1	1	10.00	1
8.	210	-0.866	0.75	7.50	7.5
9.	240	-0.5	0.25	2.50	2.5
10.	270	0	0	0.00	0

GRAPHICAL ANALYSIS

Current (I_{expt}) Vs Polarizer angle (Θ) is plotted

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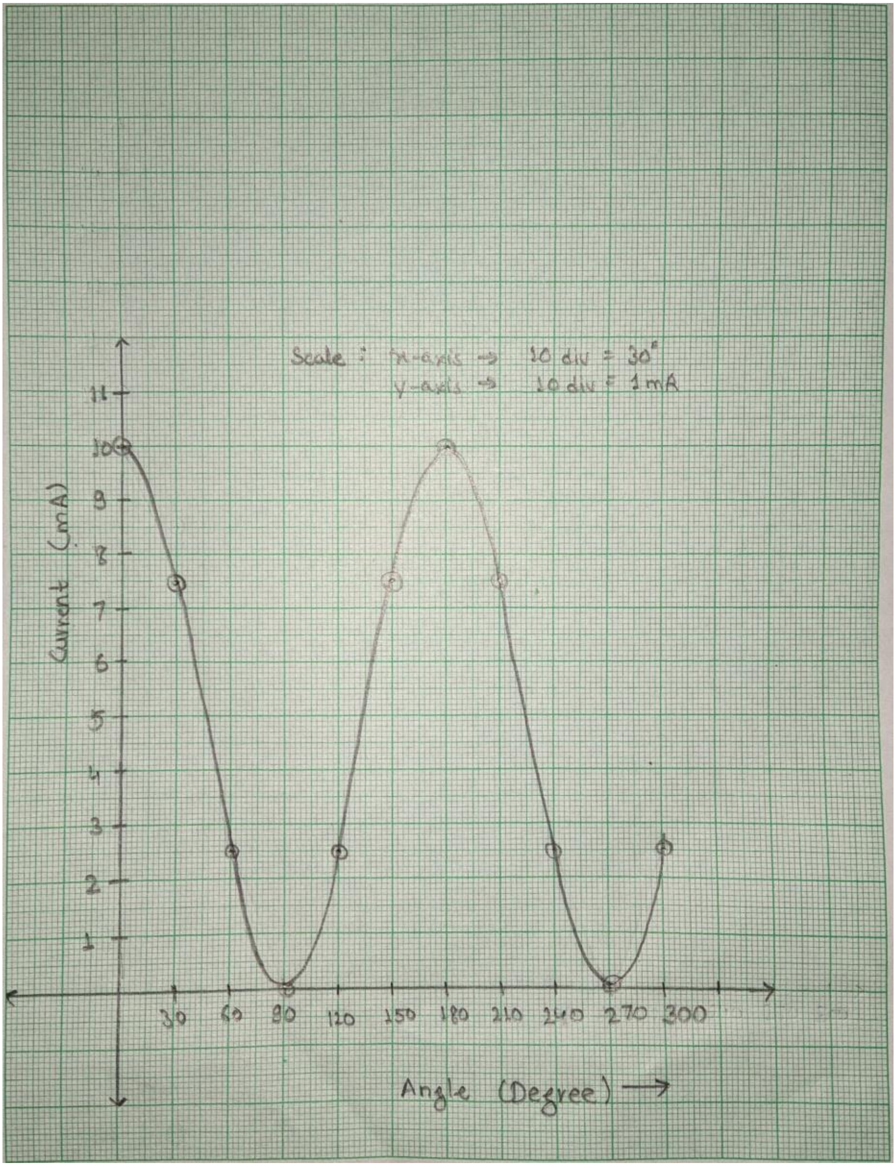

Scale : x-axis → 10 div = 30°
y-axis → 10 div = 1 mA
Current (mA)
1
2
3
4
5
6
7
8
9
10
11
30
60
90
120
150
180
210
240
270
300
Angle (Degree) →

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DISCUSSION

The experimentally measured current (I_{expt}) and (I_{theo}) that calculated using equation $I_{theo} = I_{max} \cos^2\theta$ agree within the limits of the experimental error.

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