MANUAL

MALUS' LAW APPARATUS.

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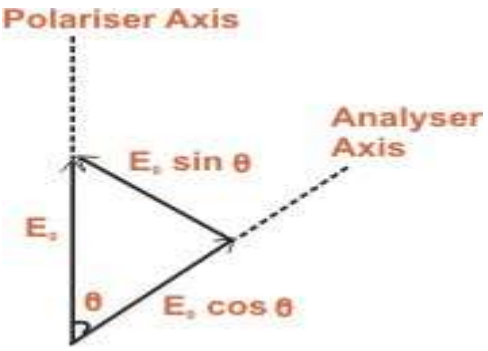
Aim: - To verify the Malus' Law of Intensity of Light.

Apparatus: - Polariser, Analyser, Light Source, Solar Cell, Digital Multimeter or Voltmeter.

Description: - According to malus, when completely plane polarized light is incident on the analyzer, the intensity I of the light transmitted by the analyzer is directly proportional to the square of the cosine of angle between the transmission axes of the analyzer and the polarizer.

i.e. $I \propto \cos^2\theta$



Suppose the angle between the transmission axes of the analyzer and the polarizer is θ. The completely plane polarized light form the polarizer is incident on the analyzer. If E_0 is the amplitude of the electric vector transmitted by the polarizer, then intensity I_0 of the light incident on the analyzer is,

$$I \propto E_0^2$$

The electric field vector E_0 can be resolved into two rectangular components i.e. $E_0 \cos\theta$ and $E_0 \sin\theta$. The analyzer will transmit only the component (i.e $E_0 \cos\theta$) which is parallel to its transmission axis. However, the component $E_0 \sin\theta$ will be absorbed by the analyser. Therefore, the intensity I of light transmitted by the analyzer is,

$$I \propto (E_0 \times \cos\theta)^2$$

$$I / I_0 = (E_0 \times \cos\theta)^2 / E_0^2 = \cos^2\theta$$

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

Therefore, $I \propto \cos^2\theta$. This proves law of malus

When $\theta = 0°$ (or 180°), $I = I_0 \cos^2 0° = I_0$ That is the intensity of light transmitted by the analyzer is maximum when the transmission axes of the analyzer and the polarizer are parallel.

When $\theta = 90°$, $I = I_0 \cos^2 90° = 0$ That is the intensity of light transmitted by the analyzer is minimum when the transmission axes of the analyzer and polarizer are perpendicular to each other

S.No:	θ Angle between optic axis of Polarizer & of analyzer	$\cos^2\theta$	V Voltage on the Cell
	0° 30° 45° 60° 90° 120° 135° 150° 180° 210° 225° 240° 270° 330° 345° 360°		

RESULT:- The intensity of the light falling on the cell would be proportional to $\cos^2\theta$