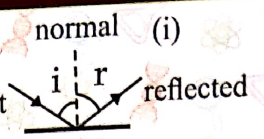
Law of malus: $I = I_0 \cos^2\theta$

GEOMETRICAL OPTICS

Reflection of Light

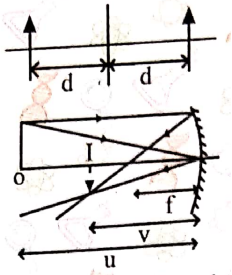
Laws of reflection:

Incident ray, reflected ray, and normal lie in the same plane. (ii) $\angle i = \angle r$



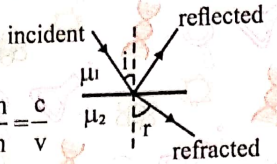
Plane mirror:

(i) The Image and the object are equidistant from mirror. (ii) Virtual image of real object.



Spherical Mirror:

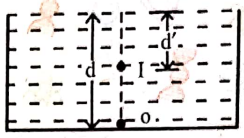
1. Focal Length $f = R/2$
2. Mirror equation: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$
3. Magnification: $m = -\frac{v}{u}$



Refraction of Light

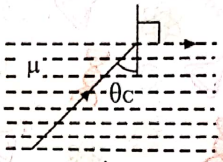
Refractive index: $\mu = \frac{\text{Speed of light in vaccum}}{\text{Speed of ligh in medium}} = \frac{c}{v}$

Snell's Law: $\mu = \frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$



Apparent depth: $\mu = \frac{\text{real depth}}{\text{apparent depth}} = \frac{d}{d'}$

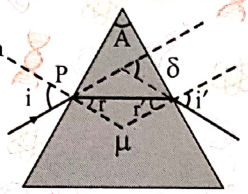
Critical angle: $\theta_c = \sin^{-1}\frac{1}{\mu}$



Deviation by a prism:

$\delta = i + i' - A$, general result

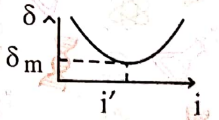
$\mu = \frac{\sin\frac{A+\delta m}{2}}{\sin\frac{A}{2}}$, $i = i'$ for minimum deviation



$\delta_m = (\mu - 1)A$, for small A

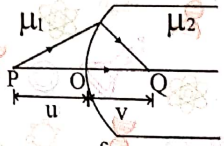
Refraction at spherical surface:

$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$, $m = \frac{\mu_1 v}{\mu_2 u}$



Lens maker's formula: $\frac{1}{F} = (\mu - 1)\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$

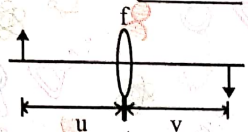
Lens formula: $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$, $m = \frac{v}{u}$



Power of the lens: $P = \frac{1}{f}$, P is diopter if f in metre.

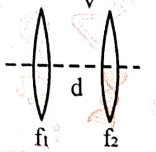
Two thin lenses separated by distance d:

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$$



Optical Instruments

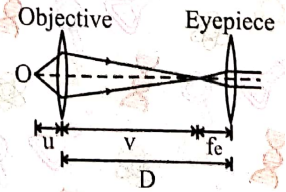
Simple microscope: $m = D/f$ is normal adjustment.



Compound microscope:

1. Magnification in normal adjustment:

$$m = \frac{v}{u}\frac{D}{f_e}$$

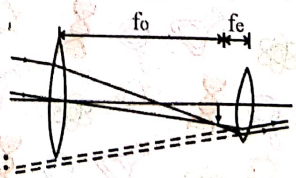


2. Resolving power: $R = \frac{1}{\Delta d} = \frac{2\mu\sin\theta}{\lambda}$

Astronomical telescope:

1. In normal adjustment:

$m = -\frac{f_o}{f_e}$, $L = f_o + f_e$



Resolving power: $R = \frac{1}{\Delta\theta} = \frac{1}{1.22\lambda}$

Dispersion

Dispersion by prism with small A and i:

1. Mean deviation: $\delta_y = (\mu_y - 1)A$
2. Angular dispersion: $\theta = (\mu_v - \mu_r)A$