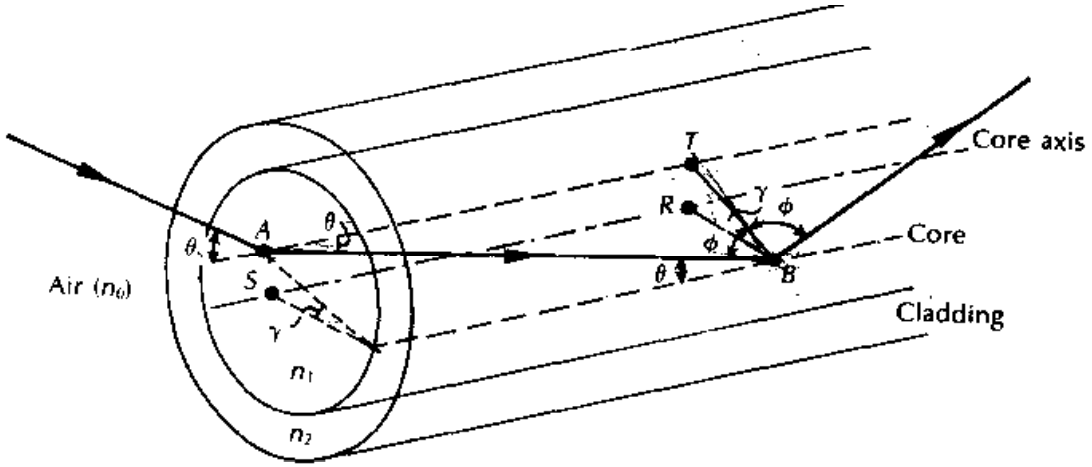
Unit - 1

Transmission of Light
Skew Rays

Skew Rays



The ray path within the fiber core for a skew ray incident at an angle θs to the normal at the air—core interface.

Y= Angle between the projection of the ray and radius of the fiber core at the point of reflection

- Plane BRS – Normal to core axis.

  Reflection at pt B at an angle Φ

  Cos γ Sin θ =cosΦ

  $=(1-\sin^2 \Phi)^{1/2}$ (A)

Skew Rays(Contd.)

Limiting Case

$\Phi = \Phi_c$ $\quad \sin \Phi_c = n_2/n_1$

From A $\quad \text{Sin}\,\theta = \cos\Phi_c / \text{Cos}\,\gamma$

Using Snell's law at point A

$no\ \text{Sin}\,\theta_a = n_1 \sin\theta \quad [n_1 \sin\theta_1 = n_2 \sin\theta_2]$

where θa = max input axial angle for meridional rays

$no \sin\theta_{as} = n_1 \cos\Phi_c / \text{Cos}\,\gamma$

where θas =max. input angle (acceptance) for skew rays

$no.\sin\theta_{as}\,\text{Cos}\,\gamma = n_1\cos\Phi_c = n1(1-n_2^2/n_1^2)^{1/2}$

$= (n_1^2 - n_2^2)^{1/2} = NA$

$\sin\theta_{as}\,\text{Cos}\,\gamma = NA$

Skew Rays(Contd.)

$\sin\theta_{as} \cos\gamma = NA$ (skew Rays)

$\sin\theta_a = NA$ (Meridional Rays)

Skew rays are accepted at larger axial angles in a given fiber than meridional rays .

$\cos\gamma = 1$; $\theta_{as} = \theta_a$

Although θa is the maximum conical half angle for acceptance of meridional rays, it defines the minimum input angle for skew rays.

Thus skew rays tend to propagate in the angular region near the outer surface of the core.

Skew rays are complimentary to meridional rays and increase the light gathering capacity of the fiber.