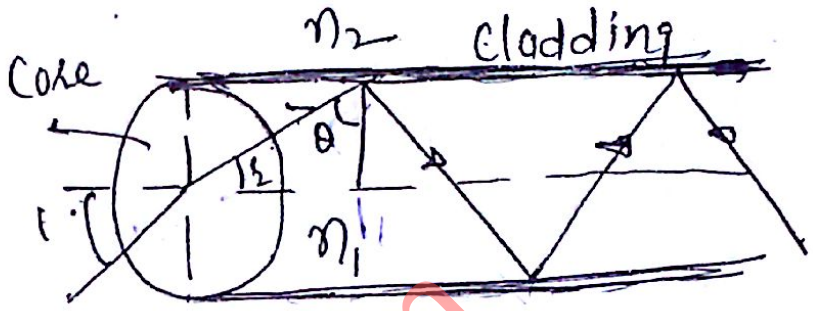
Imp. **Numerical Aperature:-**



Fibre optics consists of Rari cyclindrical cell which is made of glass having refractive index say n_1 that is called core. and the core is again surrounded By a cyclindrical cell having refractive index(n_2) called cladding.

Let us suppose that a beam of light incident at angle i it will be refracted at angle r if angle of incidence of refracted ray at core cladding interface ($\theta = 90 - r$) is greater than Critical angle it will be totally internally reflected.

$$\sin\theta \geq \frac{n_2}{n_1} \quad (T.I.R).$$

From the fig: $\theta = 90 - r$

Taking Sin on both side

$$\sin\theta = \sin(90-r) = \cos r$$

Thus $\sin\theta = \cos r$

Now find the value of $\sin r = \sqrt{1-\cos^2 r}$

$$= \sqrt{1-\sin^2\theta}$$

$$\sin r = \sqrt{1-\frac{n_2^2}{n_1^2}} \quad \left[\sin\theta = \frac{n_2}{n_1}\right]$$

By using Snell law:-

$$n_1 = \frac{\sin i}{\sin r}$$

or $\sin i = n_1 \times \sin r$ Putting value of $\sin r$

$$\sin i = n_1 \frac{\sqrt{n_1^2 - n_2^2}}{n_1}$$

$$= \sqrt{n_1^2 - n_2^2}$$

Thus the maximum angle at which the ray will be totally internally reflected are called the acceptance angle $\sin i_m = \sqrt{n_1^2 - n_2^2}$.

Thus the numerical aperature of fibre optics is

$$N.A = \sqrt{n_1^2 - n_2^2}$$

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