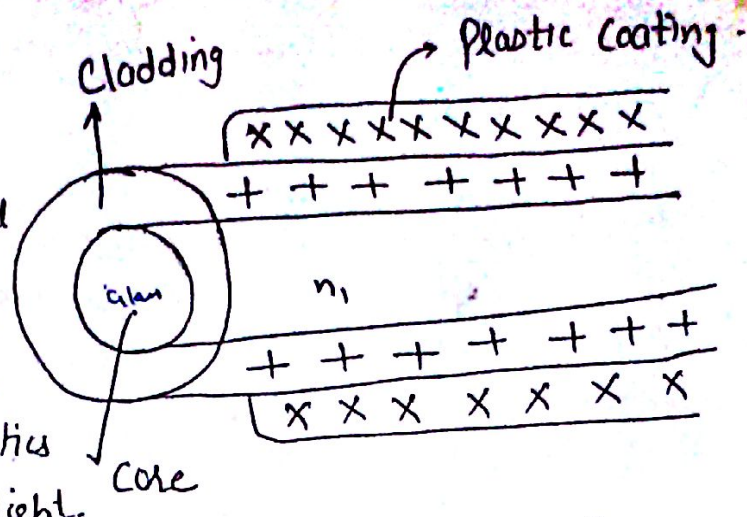


4) Fibre optics:-

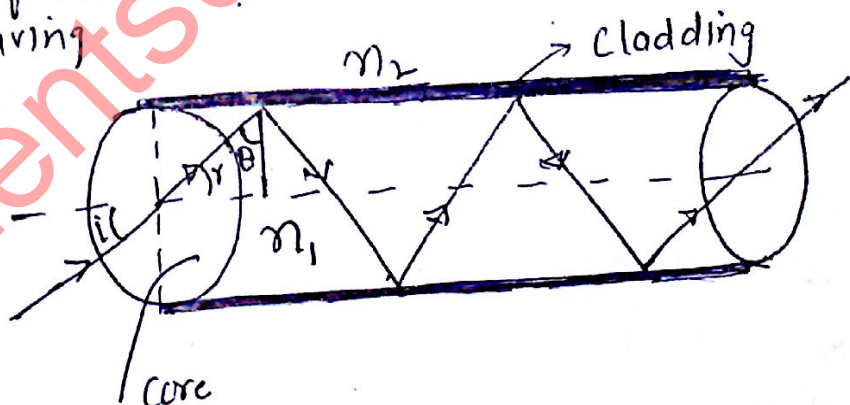
Fibre optics consists of hair thin cylindrical cell which is made of glass having refractive index say (n_1) that is called core of fibre optics and core carries the light.



The core is again surrounded by cylindrical cell having refractive index (n_2) is less than core of fibre optics. That is called cladding and cladding helps to keep light within this core of fibre optics. The diameter of core varies from $5\mu\text{m}$ to $10\mu\text{m}$ and the diameter of cladding varies from $50\mu\text{m}$ to $100\mu\text{m}$. In order to provide strength and protection to the core of fibre optics. A soft plastic coating is done.

Propagation of light through Fibre:-

Fibre optics consists of hair thin cylindrical cell having refractive index say n_1 which is made of glass that is called core of fibre optics. The core is again surrounded by cylindrical cell having refractive index (n_2) is less than core of fibre optics called the cladding. and the cladding helps to keep light within this core.



Suppose that a beam of light incident at angle i at one end of the core of the fibre optics. It will be refracted at an angle r . if angle of incidence of the refracted ray (θ) at the core cladding interface is greater than the critical angle θ_c .

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$$\sin \theta_c = \frac{n_2}{n_1} \text{ or } \theta_c = \sin^{-1} \frac{n_2}{n_1}$$

Then the ray will be totally internally reflected. In this way light ray undergoes number of total internal reflection and comes out of the other end of the fibre.

Thus light is guided through the fibre from one end to the other end by the phenomenon of total internal reflection without any energy being lost.

Thus fibre optics provides a necessary wave guide to the light.

Type of fibre:- fibre optics are two types

- ① Step index optical fibre.
- ② Graded ~~index~~ Index optical fibre.

(i) Step Index optical fibre:-

In step index optical fibre the core has uniform refractive index and the cladding has also uniform refractive index every where. Let a be the ~~core~~ radius of the core and b be the radius of the cladding.

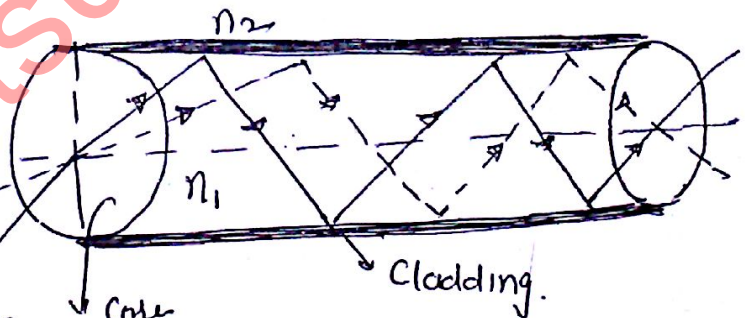
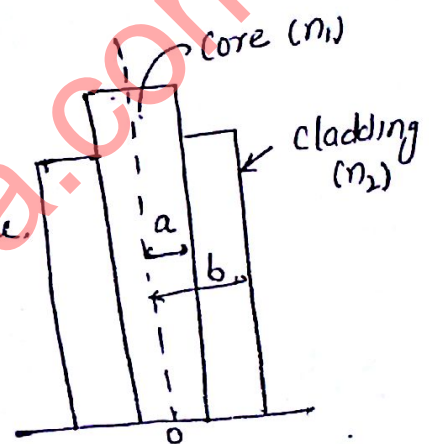
When the number of wave incident at a different angle at one end of the fibre

then they travel different path length and comes with in a different

period of time from the other end of the fibre.

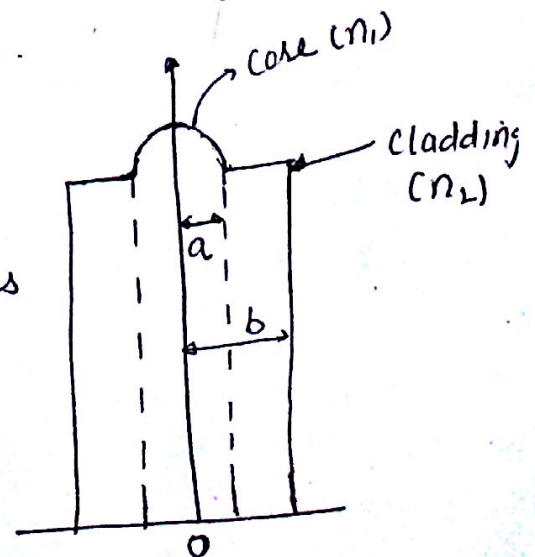
In this case pulse dispersion

is get widened as it travel along the fibre.

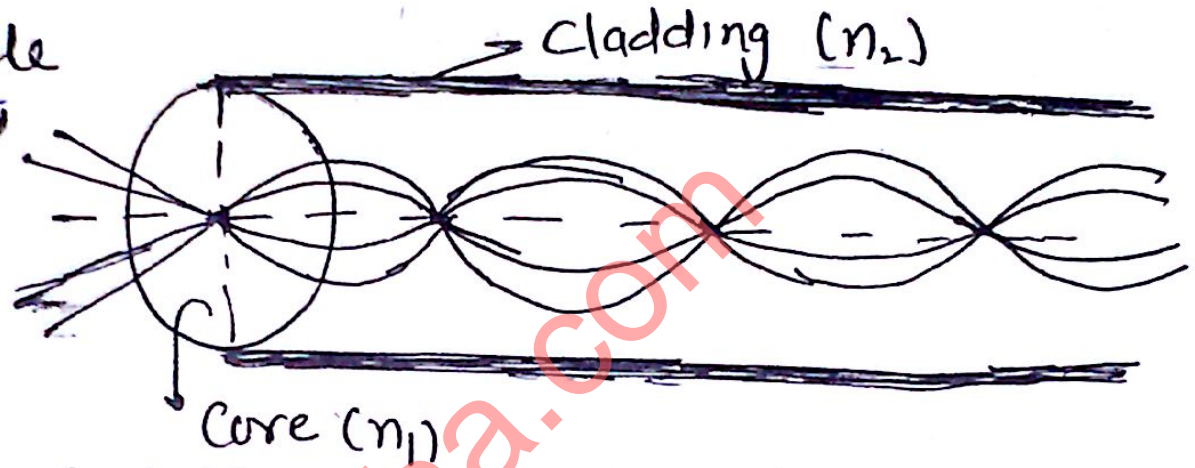


(ii) Graded Index optical fibre:-

In case of Graded Index optical fibre the core has non uniform refractive index. It decreases gradually from the centre towards the core cladding interface. But the cladding has uniform refractive index every where that is shown in this fig.



When number of wave incident at different angle at one end of the graded index optical fibre they travel different path length within the same period of time and comes out within the same period of time. Thus there is periodic self focussing is take place.



Single Mode Fibre:- If the diameter of core is about 10 μm . then such type of fibre allow one wave mode to pass through them. Then such type of fibre are called single mode optical fibre.

Multi Mode Fibre:- If the diameter of core is about 50 μm then such type of fibre allow different wave modes to pass through them. Then such type of fibre are called multi mode fibre.