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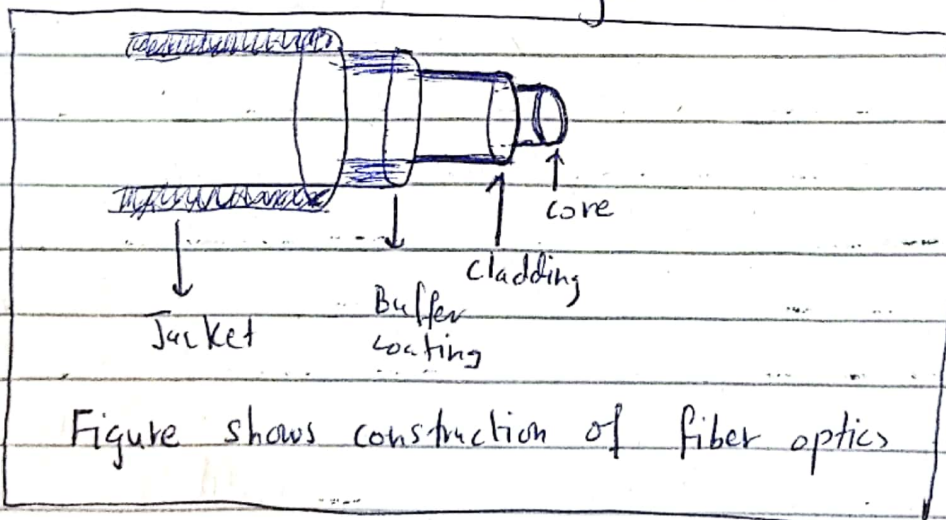
⑤ IT (Fiber optics)

• Fiber Optics

Fiber optics are thin strands of glass or plastic that are used to transmit large data over long distances without any loss. Fiber optics are crucial part of modern telecommunication systems.

• Construction

The main part of fiber optic is core that is covered by cladding. Core and cladding are further covered by buffer coating and a jacket for protecting fiber from mechanical damage.



① Core:

Core is the main and innermost part of fiber optic where light signal travels. Core is made of glass or plastic of high purity.

② Cladding:

Cladding covers core and has lower refractive index than core to ensure total internal reflection. It is made of slightly different material than core.

③ Buffer Coating:

Buffer coating protects core and cladding. It is usually made of a polymer material.

④ Jacket

Jacket is the outermost layer of an optical fiber. It is made of PVC or polythene. It protects fibre from environmental factors such as corrosion and abrasion.

≡ Working of an Optical fiber

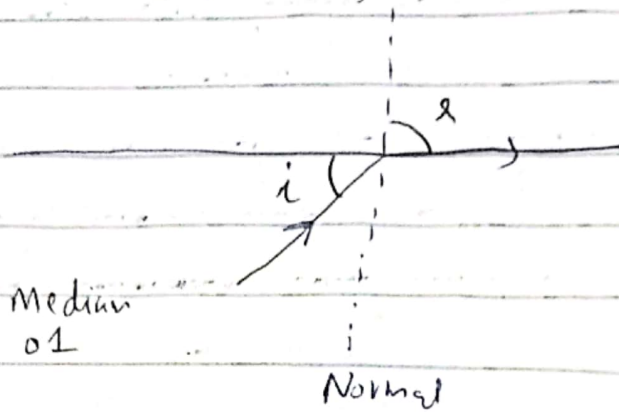
Optical fiber works on the principle of total internal reflection.

Total internal reflection:

When light ~~travels~~ moves from a denser medium to less dense medium at an angle greater than critical angle, it is reflected back in the same medium. This is known as total internal reflection.

• critical Angle

Medium n_2

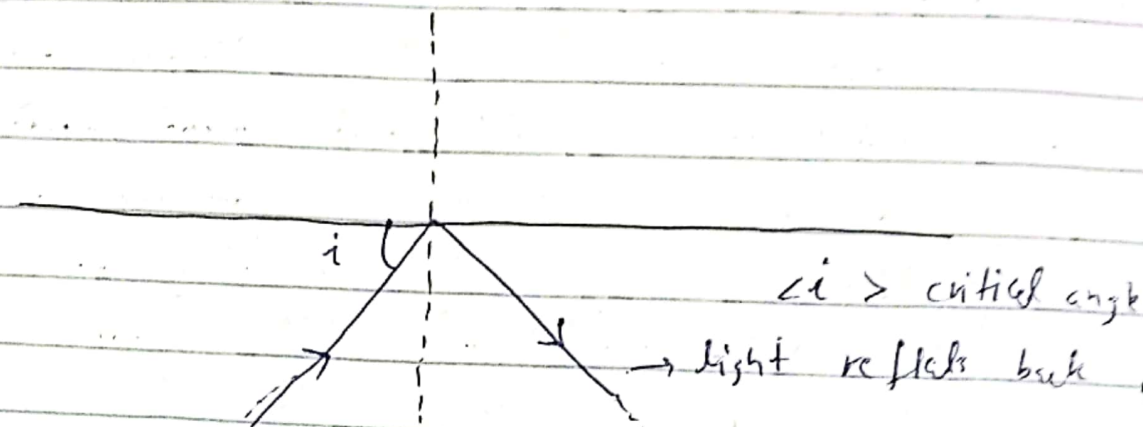


$\angle r = 90^\circ$

$\angle i = \text{critical angle}$

Medium n_1

Normal



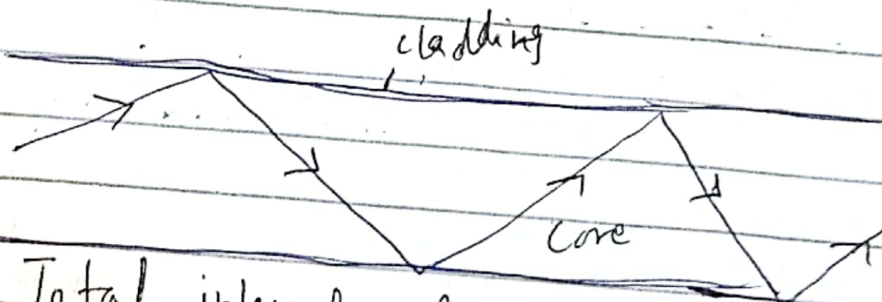
$\angle i > \text{critical angle}$

→ light reflects back

• Total internal reflection

Total Internal Reflection in Optical fibers:

When light enters in optical fiber's core from a source, it starts reflecting within the core. Angle of incidence through out remains greater than angle of critical angle, therefore, light keeps reflecting internally and so signal travel by remaining within the core.



• Total internal reflection in fibre optics

Important features of optical fibers

① High Speed data transmission

Fibre optics allow data transmission at very high speed of \approx gigabytes or terabytes per second.

② Long distances data transmission:

Fiber optics has ability to transmit data over long distances ranging from hundred to thousands of miles. It connects regions, and continents.

③ Large data capacity

High bandwidth of optical fibers allow large amount of data to transmit simultaneously.

④ Less signal loss and attenuation:

Fiber optics uses phenomenon of total internal reflection which has minimal signal loss, therefore it can transmit data efficiently without attenuation.

⑤ Enhanced Security and Reliability:

Optical fiber systems are complex with multi layer system therefore it is difficult to data passing through it. This makes it more secure and reliable for sensitive information transmission.

≡ Importance of Optical fibers in different Sectors
Optical fibers are used in following areas or sectors for reliable and efficient communication:

- Telecommunication
- Internet Services
- Data Centres communication
- Defense and Aerospace
- Underwater communication
- Telemedicine (use in medical imaging)
- Fiber optics sensors in industries

≡ Disadvantages / Limitations :

Some limitations of fiber optics are :

- High installation and maintenance cost
- Specific equipment and expertise requirement
- Unreliability with existing copper-based systems
- Difficult and complex fault tracing process