**Optical Fibres**

**Q1.** Explain the phenomenon of Total internal reflection.

**Ans.** Whena ray of light suffers refraction at a boundary while travelling from a rarer medium to a denser medium , it bends towards the normal . Similarly , if a ray of light travels from a denser medium to a rarer medium , it bends away from the normal .

Two diagrams

In both the cases angle of refraction increases with increase in the angle of incidence. When angle of incidence is increased in case two then for a particular angle of incidence **Ic** the angle of refraction becomes 90° that angle is called angle of critical incidence .

Diagram left

When the angle of incidence increases the angle of critical angle the refracted ray does not enter the rarer medium and is reflected back to the denser medium .

Thus the phenomenon of light reflecting back into the denser medium , when incident a boundary of rarer medium with angle greater than critical angle , is called **Total Internal Reflection** .

**Q2.** Write a note on optical fibres.

**Ans.** Optical fibres are long thin hair like cables made of plastic or glass to electric light along their length.

An Optical fibre generally has three co-axial regions.

1.**Core:** The innermost region of nearly 50µm in diameter which is optically dense as compared to cladding is called core.

2.**Cladding:** The region surrounding the core with 125µm diameter which is rarer as compared to core is called cladding.

3.**Sheath:** The outermost skin of optical fire to protect it from external damage is called sheath.

One diagram left

**Q3.** Why is cladding required when light travels through core only ?

**Ans.** Cladding is required as :

1. It enhances the mechanical strength of fibre.
2. Protects core from surface contamination.
3. Reduces scattering loss at the core.

**Q4.** Derive expression for acceptance angle of an optical fibre.

**Ans.** The maximum angle of incidence for which the light incident on the core propagates successfully through the fibre is called acceptance angle (θ0).

Consider a step index optical fibre with core of refractive index µ1 and cladding of refractive index µ2 .

Diagram

Where then and

Therefore, - equation 1

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When at cladding core interface

- equation 2

**=1**

Expression for acceptance angle: The solid angle made by acceptance angle in all directions is called acceptance cone all light incident in this cone propagates through the fibre successfully.

One diagram

**Q5.** Describe fibre optic communication system.

**Ans.** Principle Elements of typical optical communication system are :

Diagram

1. Telephone (mike) i/p
2. Wire pairs (electrical voice )
3. Encoder
4. Optical transmitter
5. Optical fibre
6. Optical receiver
7. Decoder
8. Wire pair (Electrical)
9. Telephone (speaker) o/p