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DATE:

Experiment - 2

Numerical Apperature of Optical fibre.

1.) Explain any one application based on this experiment. (Related to your core branch)

Ans. Optical fibres have a wide range of applications. They are as follows:

a) Fibre optic communication:

i) It is a method of transmitting information from one place to another by sending pulses of infrared light through an optical fibre.

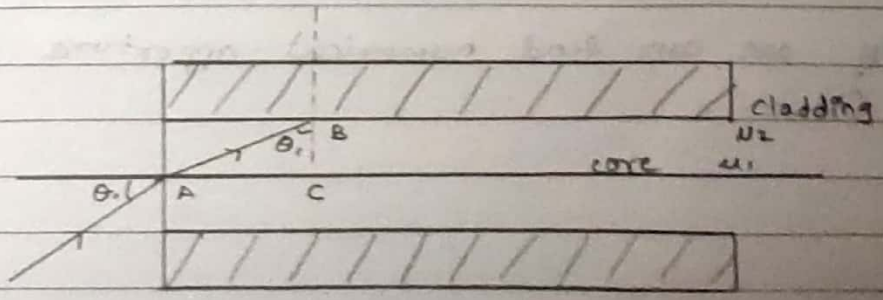
2) The light is a form of carrier wave that is modulated to carry information. Fiber is preffered over electrical cable when high bandwidth, long distance or immunity to electromagnetic interference is required.

3) This type of communication can transmit voice, video and telemetry through local area networks or across long distance.

4) Optical fibre is used by many telecommunications companies to transmit telephone signals, Internet communication and cable television signals.

2) Explain any other technique of experiment other than the one performed which will achieve the result and fulfill the aim of experiment.

Ans.



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Given diagram is of optic fibre with core (μ_1) and cladding (μ_2) and refractive index of the surrounding is μ_0.

Let critical angle be θ_c formed at B which is gained because of acceptance angle θ_0.

Now,

sine of acceptance angle is numerical apperture,

Applying snell's law at A,

$$\mu_0 \sin\theta_0 = \mu_1 \sin(90 - \theta_c) \quad - (i)$$

Applying snellis law at B,

$$\mu_0 \sin\theta_c = \mu_2 \sin 90$$

$$\sin\theta_c = \frac{\mu_2}{\mu_1} \quad - (ii)$$

from (i), $\mu_1 \cos\theta_c = \mu_1 \sqrt{1 - \sin^2\theta_c}$

$$\therefore \mu_0 \sin\theta_0 = \mu_1 \sqrt{1 - \frac{\mu_2^2}{\mu_1^2}}$$

$$\therefore \theta_0 = \sin^{-1}\left(\frac{\sqrt{\mu_1^2 - \mu_2^2}}{\mu_0}\right)$$

For surrounding to be air $\mu_0 = 1$

$$NA = \sin\theta = \sqrt{\mu_1^2 - \mu_2^2}$$

This way we can find numerical apperture (NA) of any optical fibre.