Experiment no. 1

Aim: To study refractive index, Critical angle of incidence, NA and Acceptance Angle

Lab Outcome: Analyse the propagation characteristics of optical fiber

Software: Scilab

Theory:

a) Refractive index: It is the ratio of velocity of light in the vacuum to the velocity of light through the material.

$$n = \frac{\text{velocity of light in a vacuum}}{\text{velocity of light in the medium}} = \frac{c}{v}$$

b) Critical angle of incidence: It is the angle of incidence at core cladding interface at which refracted ray travels parallel to the core cladding interface

$$\sin \phi_c = \frac{n_2}{n_1}$$

c) Acceptance angle: The maximum angle in which external light rays may strike the air/glass interface and propagate down the fiber (undergo total internal reflection).

d) Total Internal Reflection: When the angle of incidence is greater than Critical angle of incidence, then entire ray is reflected back into the same medium, this is called total internal reflection(TIR)

e) Numerical Aperture : It is measure of light gathering capacity of the fiber. In optics, the numerical aperture (NA) of an optical system is a dimensionless number that characterizes the range of angles over which the system can accept or emit light.

$$NA = n_0 \sin \theta_a = (n_1^2 - n_2^2)^{\frac{1}{2}}$$

The NA may also be given in terms of the relative refractive index difference (Δ) between the core and the cladding which is defined as

$$\Delta = \frac{n_1^2 - n_2^2}{2n_1^2}$$

$$\simeq \frac{n_1 - n_2}{n_1} \quad \text{for } \Delta \ll 1$$

$$\boxed{NA = n_1(2\Delta)^{\frac{1}{2}}}$$

Problem statements: Solve the given problems

Attach print out of program and output
Conclusion: Write appropriate conclusion