QUAID-E-AWAM UNIVERSITY OF ENGINEERING SCIENCE & TECHNOLOGY, NAWABSHAH.
DEPARTMENT OF ELECTRONIC ENGINEERING
LASER AND FIBER OPTICS 05ES (2nd Term, Final Year)
Lab Experiment # …….

Name: _____ Roll No: _____ Date: _____

MEASUREMENT OF NUMERICAL APERTURE

PERFORMANCE OBJECTIVES

The objective of this experiment:

- Is to estimate the Numerical Aperture of the 1mm diameter plastic fiber at 650nm

HARDWARE REQUIREMENTS

- Module Kit: OFT Trainer
- Numerical Aperture Measurement Unit
- Fiber cables: 1m and 3m
- Power Supply module, Input: 220-240 V AC, 50Hz. Output: +5V DC.
- Power interface cable with DIN jacks at both ends.
- Two channel, 20MHz Oscilloscope.
- Function generator, 1Hz-10 MHz
- BNC-BNC cables.
- Regular patch cord.
- 3-plug patch cord.

DISCUSSION

Numerical Aperture of a fiber is a measure of the acceptance angle of light in the fiber.

Light which is launched at angles greater than this maximum acceptance angle does not get coupled to propagating modes in the fiber, and therefore does not reach the receiver at the other end of the fiber. The Numerical Aperture is useful in the computation of optical source to the fiber, from the fiber to a photo detector, and between two fibers.

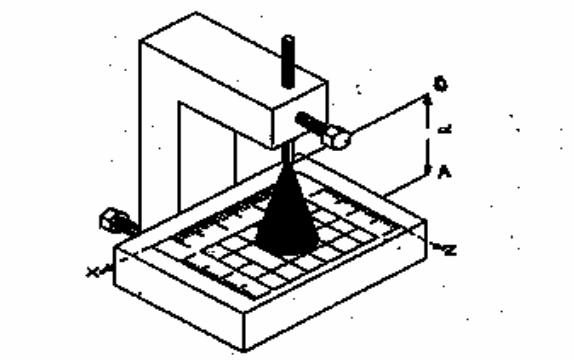
PROCEDURE

1. The OFT Trainer comes with a power supply module, operating at 220-240AC, 50Hz. The output of the power supply module is +5V DC (regulated) and is available through a DIN socket. A power-interface cable with DIN jacks at both ends is provided for connecting the power supply module to the OFT.

2. Connect one end of the power-interface cable to the power supply module, and the other end to the OFT.
3. Ensure that the shorting plug of Tx data shorting link S4, Coded data shorting link S6, and Tx clock shorting link S5 in the Manchester coded block are in position. Also ensure that the shorting plug of clock select jumper JP2 is across the posts B & A1. A TTL signal from the multiplexer is should now be driving LED2 in the optical Tx2 block. This experiment is best performed in a less illuminated room.

NUMERICAL APETURE MEASUREMNT

4. Insert one end of the fiber into Numerical Aperture Measurement unit as shown in figure. Adjust the fiber such that its tip is 10 mm from the screen.

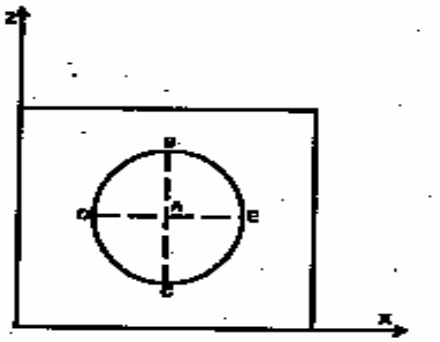


Numerical Aperture Measurement set-up

5. Gently tighten the screw to hold the fiber firmly in place.

6. Connect the other end of the fiber to LED2 through the simplex connector. The fiber will project a circular patch of red light on to the screen. Let d be the distance between the fiber-tip and the screen. Now measure the diameter of the circular patch of red light in two perpendicular directions (BC and DE as shown in figure). The mean radius of the circular patch is given by:

$$X = (DE + BC) / 4$$



7. Carefully measure the distance d between the tip of the fiber and the illuminated screen(OA in figure) the Numerical Aperture of the fiber is given by:

$$NA = \sin\theta = \frac{X}{\sqrt{(d2 + X2)}}$$

Repeat Steps 4 to 7 for different values of d. Compute the average value of Numerical Aperture.

OBSERVATIONS

S. No.	d	DE	BC	X	NA	Average value of NA

REVIEW QUESTIONS

1. Define Numerical Aperture?

_____
_____
_____

2. State Snell's law?

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_____
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3. Derive the expression NA = $\sqrt{\ }(n_1^2 - n_2^2)$

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4. Reason out that the measurement carried out in this experiment really do measure the NA of the fiber.

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