Sardar Patel Institute of Technology
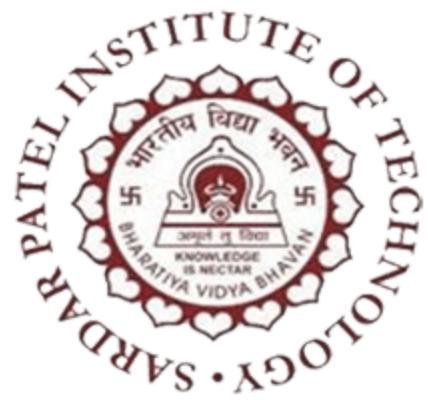# (Electronics & Telecommunication Department)

OFC
Experiment 1

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DETAILED OBJECTIVE: The primary objective of this laboratory experiment is to measure the Numerical Aperture (NA) of a given optical fibre using the Scientech 2501A TechBook with the associated Numerical Aperture measurement jig. The experiment aims to provide students with hands-on experience in setting up the equipment, performing measurements, and analysing results to determine the Numerical Aperture of the optical fibre accurately. Students are expected to compare theoretical and observed values and comment on the same in inference section.

Prelab,Postlab,Readings and Conclusion:

Reading - Exp 1 - o/c

1)

Sr no.	Diameter (w)	Length (L)	Formula
1	10	1.5	0.316
2	15	2.3	0.31
3	20	2.8	0.33
4	25	3.7	0.32

$$\text{Formula} \atop (NA) = \frac{w}{\sqrt{4L^2 + w^2}}$$

$$NA = \sqrt{n_1^2 - n_2^2}$$

2) Theorotical

$$n_1 = 1.492$$
$$n_2 = 1.406$$

$$\boxed{NA = 0.499}$$

Error :- |mesured - actuall| / actual × 100

= 35.8 %.

Conclusion:-
The values achieved by the reading are consisent & we have a average error of 35.5%.

28/1/26

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Pre-Lab :-

1. NA

Numerical aperture of an of indicates its ability to collect
& guide light. It defines the max angle at which
light can enter the fiber & still propogate.
Higher NA means more light - gathering capacity

Formula - $NA = \sin \theta_a$ → acceptance angle

$$= \sqrt{n_1^2 - n_2^2}$$

→ refractive index

2. Setup & Calibration

Components :- Techbook with power supply &
mains cord, optical fibre cable
& NA measurement Jig

~~Idea Steps~~ Steps :-
ⓐ Properly align soource & fibre
ⓑ clean fibre ends
ⓒ keep screen ⊥ to the fibre
ⓓ Accurate distance & spot diameter
readings

3. Challenges & Solutions

ⓐ Misalignment

soln :- to align the components with the
help of a proper measuring scale
& to avoid extra error

(b) Dirty Fibre Ends
   Sol⁹:- clean the reating plate & components
          neeessary before the experiment

(c) Measurement Error
   Sol:- Taking more reatings ~~to also want~~
         to get a better understanding of
         the actual range of the value

(d) Ambient Light
   Sol :- closing the curtains & performing
          in low light in order to
          get sharp light.

Post - Lab :-

1. Data Analysis:-
      Done on previous page.
   The values of the reatings were consisting
   & same so the reatings were accurate

2. Comparison with theoretical values:

   $$\underline{\frac{\text{The avg value of reatings} = 0.32}{\text{The Theoretical value} = 0.499}}$$

        was calculated by

        $$NA = \sqrt{n_1^2 - n_2^2}$$

   The values were close enough with a small
   % of deviation. This variation may be
   attributed to measurement errors

such as inaccurate θ_a, improper alignment, divergence.

3. Significance of NA

It determines the light – collecting ability of an optical fibre. Higher NA allows better light coupling but inc. modal dispersion. Thus, NA affects signal strength, BW & overall performance.

4. Improvements & Recommendations

Accuracy can be improved by using a well-collimated laser source, precise alignment of the setup, controlled light conditions & Multiple readings.

5. Real World Applications

NA is imp. in fibre optic comm. for efficient light coupling. Proper NA selection reduces signal loss & improves transmission quality in app. like internet comm. & medical imaging.