



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad – 500 043

LABORATORY WORK SHEET

Date: 22/07/2022

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Exp No: 07 Experiment Name: EVALUATION OF NUMERICAL APERTURE OF
A GIVEN FIBRE

DAY TO DAY EVALUATION:

	Preparation	Algorithm	Source Code	Program Execution	Viva	Total
		Performance in the Lab	Calculations and Graphs	Results and Error Analysis		
Max. Marks	4	4	4	4	4	20
Obtained	4	4	4	4	4	20

Signature of Lab I/C

START WRITING FROM HERE:

AIM: To determine the numerical aperture of a given optical fibre.

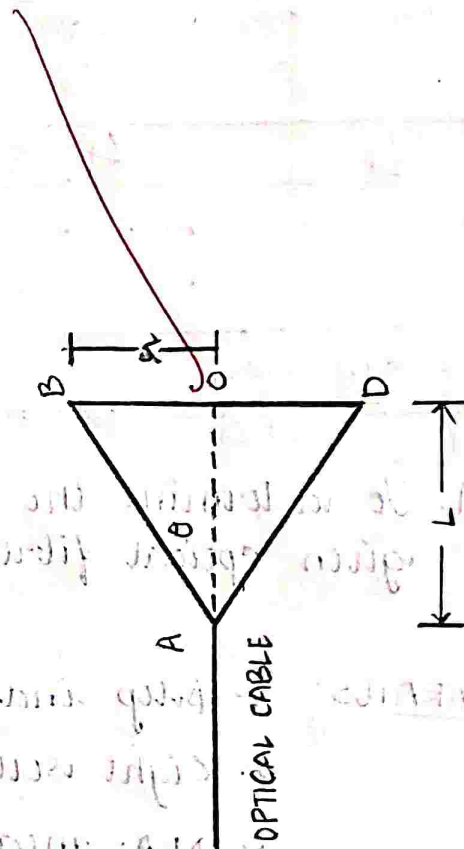
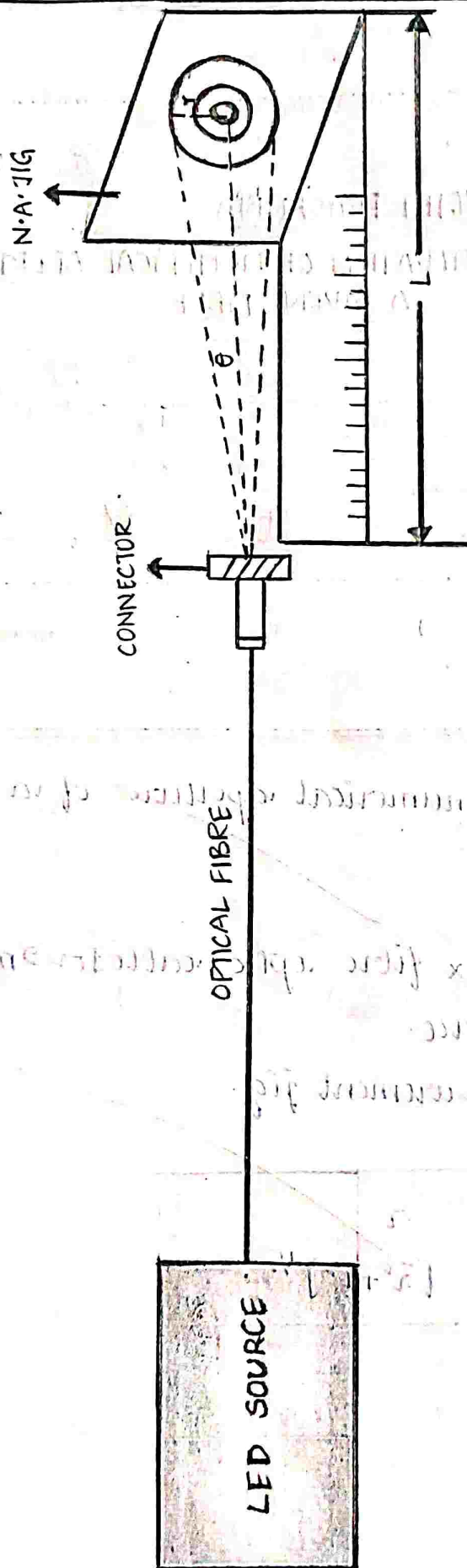
APPARATUS:

1. Step index fibre optic cable 1 or 2 m length
2. Light source.
3. N.A. measurement jig.

FORMULA:

$$N.A. (\text{sine}) = \frac{n}{[n^2 + L^2]^{1/2}}$$

ARRANGEMENT FOR N.A. MEASUREMENT



P.V. Red

OBSERVATION TABLE :

S.NO	L (mm)	R (mm)	NA = $\frac{R}{[R^2 + L^2]^{1/2}}$	θ (degrees)
1	4	2.5	0.529	31.73
2	6	5	0.6401	39.79
3	12	7.5	0.847	57.88
4	14	10	0.5812	35.53
5	20	12.5	0.529	31.93

CALCULATIONS:

$$\text{Avg of N.A} = \frac{0.529 + 0.6401 + 0.847 + 0.5812 + 0.529}{5} = 0.6254$$

$$\text{Avg of } \theta = \frac{31.93 + 39.79 + 57.88 + 35.53 + 31.93}{5} = 39.412$$

RESULT: The NA of the optical fibre is 0.6254 mm

The Acceptance angle θ is 39.412°

VIVA VOCE:

1. Define Acceptance angle.

Acceptance angle is the maximum angle at which incoming sunlight can be captured by a solar concentrator. Its value depends on the concentration of the optic and the refractive index in which the receiver is immersed.

2. Define Numerical aperture.

In optics, the numerical aperture of an optical system is a dimensionless number that characterizes the range of angles over which the system can accept or emit light.

3. Explain construction of optical fiber

Modern optical fibres are formed by two layers of glass. The inner fiber core ($8\mu\text{m}$) is surrounded by a concentric core of lower index glass known as cladding ($125\mu\text{m}$). The cladding is surrounded by a protective layer. The total internal reflection occurs at the core-cladding interface.

4. Discuss principle of optical fiber

Optical fiber is a cylindrical dielectric waveguide (non conducting waveguide) that transmits light along its axis, by the process of total internal reflection. The fiber consists of a core dielectric materials. To confine the optical signal in the core, the R.I of the core must be greater than that of the cladding.

5. What are the advantages of using fiber optic communication?

Some of the major advantages of optical fibers are:

- (i) Economical and cost effective
- (ii) Less power consumption.
- (iii) Thin and non flammable.
- (iv) Less signal degradation & excellent data security.
- (v) Flexible and light weight.

Sax