Name: Vidhi Shah Reg. No.: 21BCE1297 Batch: L3+L4 Dataset: 2

EXPERIMENT: No. 6 Optical Fibre

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- **AIM:**

1) To determine the Numerical Aperture (NA) and acceptance angle (θ_a) of the given two different (1 meter and ½ meter cables) optical fibers to find their suitability in telecommunications applications.

2) Observing the optical power losses, when light is passing through two different (1 meter and ½ meter cables) optical fibres during, (a) When they are not coupled with each other and (b) when they are coupled each other through an in-line adaptor.

- **APPARATUS REQUIRED:**

→ Fiber optic LED light source, Fiber optic power meter, Fiber Optic (FO) cable 1 meter, FO cable ½ meter, In-line adaptor (to connect 2 cables), NA-Jig (L-shape with scale on one side and connector on other side).

- **FORMULA:**

$$NA = \sin\theta_a = \frac{W}{\sqrt{(4L^2 + W^2)}} \quad \text{(No unit)}$$

where, W = Diameter of the spot (m)
L = Distance between the fiber end and the screen (m)
θ_a = Acceptance angle (°)

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Teacher's Sign. : _____

- **OBSERVATION TABLE :**

(i) Optical fiber cable with length of $\frac{1}{2}$ m :

Power loss = 37.4 dB

Sr. No.	L (mm)	W (mm)	NA (No unit)	θ_a (deg)
1.	22	30	0.563	34.287
2.	20	25	0.530	32.005
3.	14	20	0.581	35.538
4.	12	15	0.530	32.005
5.	4	10	0.781	51.340
		Mean	0.597	37.035

(ii) Optical fiber cable with length of 1m :

Power loss = 57.4 dB

Sr. No.	L (mm)	W (mm)	NA (No unit)	θ_a (deg)
1.	23	30	0.546	33.111
2.	18	25	0.570	34.778
3.	14	20	0.581	35.538
4.	12	15	0.530	32.005
5.	6	10	0.640	39.806
		Mean	0.574	35.048

- CALCULATIONS:

① 1 meter:

i) $NA_1 = \frac{30}{\sqrt{3016}} = 0.546$

$\theta_{a_1} = \sin^{-1}(0.546) = 33.111°$

ii) $NA_2 = \frac{25}{\sqrt{1921}} = 0.570$

$\theta_{a_2} = \sin^{-1}(0.570) = 34.778°$

iii) $NA_3 = \frac{20}{\sqrt{1184}} = 0.581$

$\theta_{a_3} = \sin^{-1}(0.581) = 35.538°$

iv) $NA_4 = \frac{15}{\sqrt{801}} = 0.530$

$\theta_{a_4} = \sin^{-1}(0.530) = 32.005°$

v) $NA_5 = \frac{10}{\sqrt{244}} = 0.640$

$\theta_{a_5} = \sin^{-1}(0.640) = 39.806$

② 1/2 meter:

i) $NA_1 = \frac{30}{\sqrt{2836}} = 0.563$

$\theta_{a_1} = \sin^{-1}(0.563) = 34.287°$

ii) $NA_2 = \frac{25}{\sqrt{2225}} = 0.530$

$\theta_{a_2} = \sin^{-1}(0.530) = 32.005°$

iii) $NA_3 = \frac{20}{\sqrt{1184}} = 0.581$

$\theta_{a_3} = \sin^{-1}(0.581) = 35.538°$

iv) $NA_4 = \frac{15}{\sqrt{801}} = 0.530$

$\theta_{a_4} = \sin^{-1}(0.530) = 32.005°$

v) $NA_5 = \frac{10}{\sqrt{164}} = 0.781$

$\theta_{a_5} = \sin^{-1}(0.781) = 51.340°$

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- **RESULTS:**

(i) The Numerical Aperture of the given optical fiber (1 meter) = 0.574

(ii) The acceptance angle for the given optical fiber (1 meter) = 35.048°

(iii) The Numerical Aperture of the given optical fiber (½ meter) = 0.597

(iv) The acceptance angle for the given optical fiber (½ meter) = 37.035°

(v) The optical power loss, when the light is passing through optical fiber cable (1 meter) = 57.4 dB

(vi) The optical power loss, when the light is passing through optical fiber cable (½ meter) = 37.4 dB