

Department of Physics

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Numerical Aperture of an Optical Fibre

AIM: To determine the Acceptance angle and Numerical aperture of the given optical fiber.

APPARATUS: Laser source, Optical fiber, Screen, Scale.

PRINCIPLE: The Sine of the acceptance angle of an optical fiber is known as the numerical aperture of the fiber. The acceptance angle can also be measured as the angle spread by the light signal at the emerging end of the optical fiber. Therefore, by measuring the diameter of the light spot on a screen and by knowing the distance from the fiber end to the screen, we can measure the acceptance angle and there by the numerical aperture of the fiber.

FORMULA: The Acceptance angle,

Where D – the diameter of the bright circle formed on the screen,

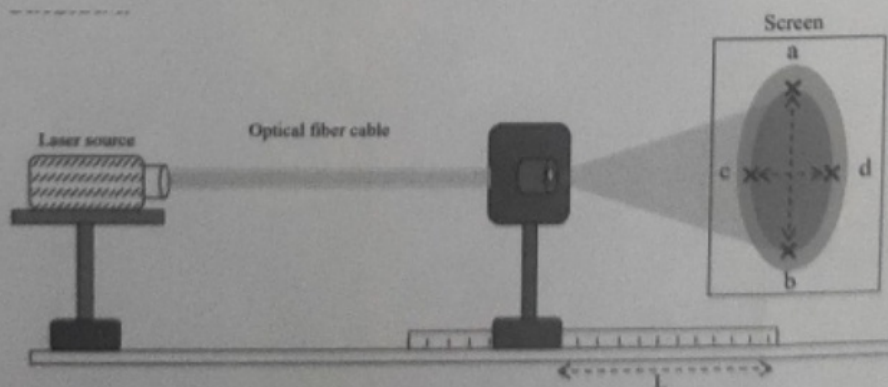
L – the distance between the optical fiber end and the screen. And the Numerical Aperture,

$$NA = \sin \theta_0$$

Procedure:

1. Switch on the laser source and adjust the distance between output end of the optical fiber and the screen ' L ' (say 2 cm).
2. Place a graph sheet on the screen and observe the circle formed on the graph sheet.
3. Mark the points 'a', 'b', 'c' & 'd' on the shown in the diagram. Note down the horizontal diameter D_1 and vertical diameter D_2 of the circle in the tabular column.
4. Repeat the above steps for different values of L (for 4cm, 6cm,).
5. Find the Acceptance angle from the tabular column and hence the Numerical aperture.

Diagram



Observations:

Trail No.	L (in cm)	Horizontal diameter D1 (in cm)	Vertical diameter D2 (in cm)	Mean Diameter D (in cm)	Acceptance angle θ_0	Numerical aperture (NA)
1	0.1	0.041	0.04	0.0405	11.76363	0.20387
2	0.15	0.059	0.06	0.0595	11.51504	0.19962
3	0.2	0.081	0.08	0.0805	11.689011	0.2025
4	0.25	0.1	0.11	0.105	12.21216	0.21153
5	0.3	0.122	0.121	0.1215	11.76363	0.20387

Result: The Angle of acceptance and Numerical aperture of the given optical fiber are found to be

$$\theta_0 = 11.78869625$$

$$NA = 0.204301268$$