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OPTICAL FIBER CHARACTERIZATION

Apparatus Available:-

Diode Laser
Optical fiber
Laser-fiber Coupler
Optical rail
Pinhole photo detector
Power supply for laser
Detector Output measurement unit.

SLO:

To determine the numerical aperture of given multimode optical fiber

Theory:-

A multi-mode optical fiber will only propagate light that enters the fiber within a certain cone, known as the acceptance cone of the fiber. The half-angle of this cone is called the acceptance angle, θ_a.

$$\text{Acceptance angle } \theta_a = \tan^{-1}(D/z).$$

where, D is the diameter of far field intensity at 5% intensity level of the maximum attainable intensity and z is the distance between the detector and the fiber output end.

$$NA = \sin\theta_a.$$

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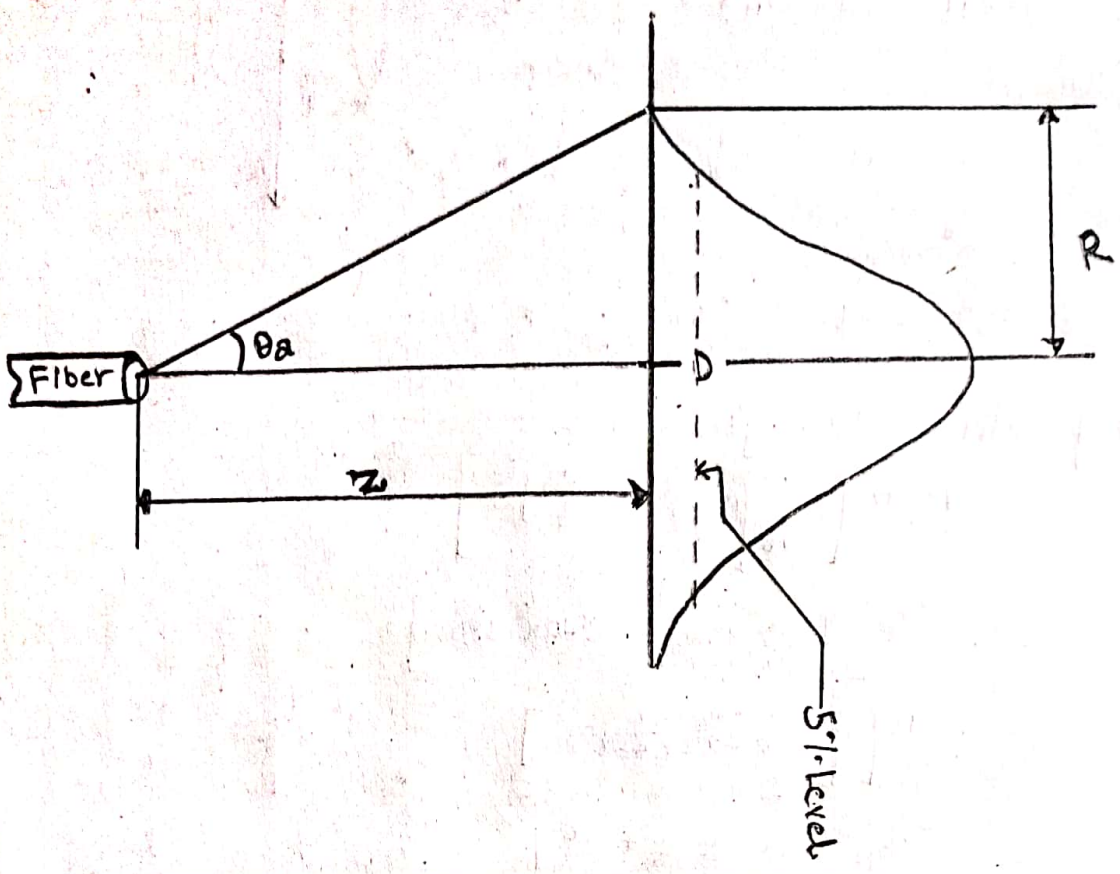

z	Micrometer readings (mm)	Detector o/p current	D
1 mm	21.10	0.01	1.9 mm
	20.90	0.01	
	20.70	0.04	
	20.50	2.4	
	20.30	12.5	
	20.10	29.1	
	19.90	55.5	
	19.70	94.1	
	19.50	127.4	
	19.30	138.0	
	19.10	113.4	
	18.90	64.4	
	18.70	22.8	
	18.50	5.1	
	18.30	1.0	
	18.10	0.02	
	17.90	0.01	

Calculation:-

From graph, $D = 1.9\,mm$,

$$R = \frac{D}{2} = \frac{1.9\,mm}{2} = 0.95\,mm$$

$z = 1\,mm$

$$\theta_a = \tan^{-1}\left(\frac{R}{z}\right) = \tan^{-1}\left(\frac{0.95}{1}\right) = 43.53^\circ$$

Numerical Aperture (NA)

$$= \sin(\theta_a) = \sin(43.53^\circ) = 0.689$$

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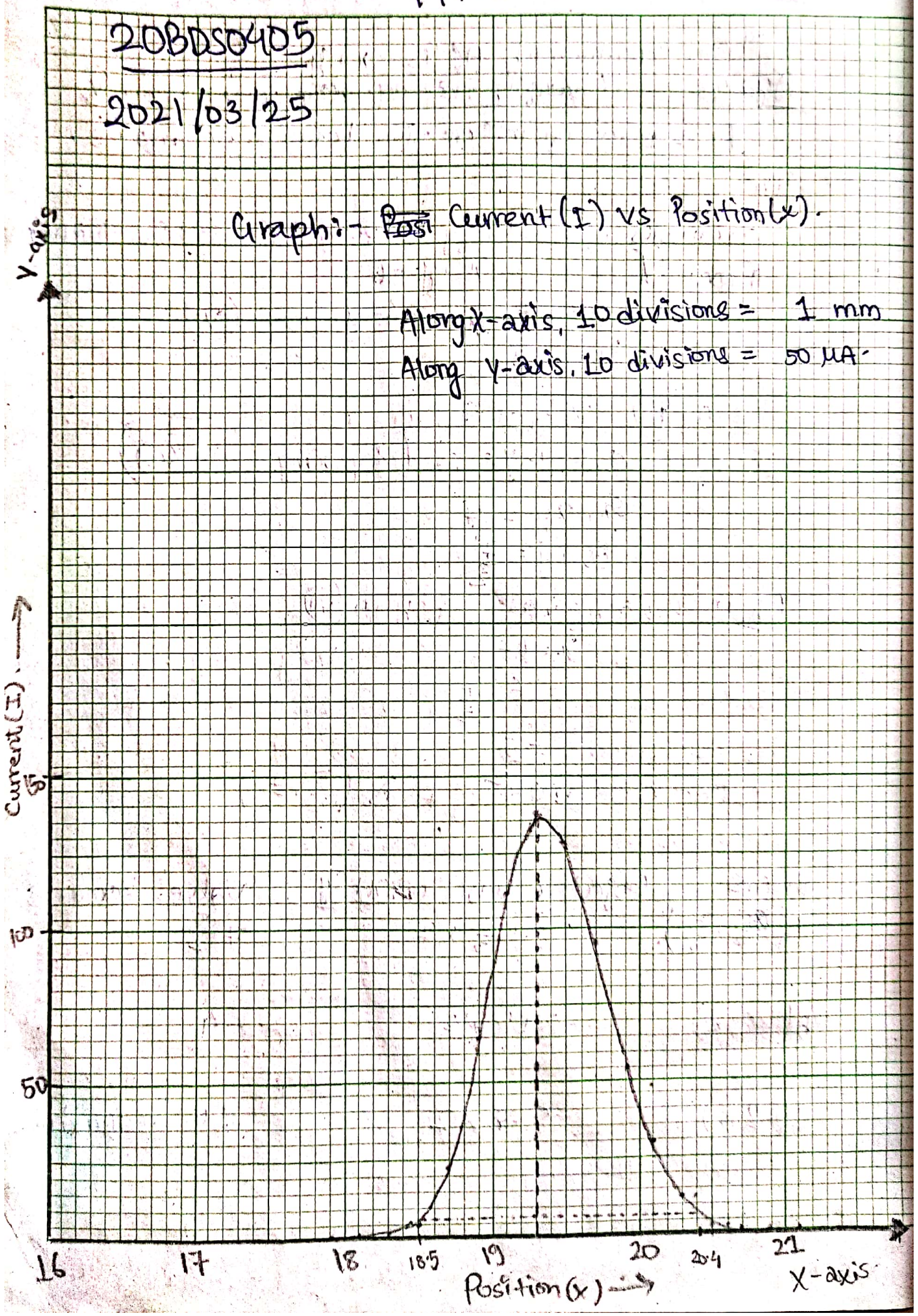
Graphi:- ~~Posi~~ Current (I) vs Position (x).

Along X-axis, 10 divisions = 1 mm

Along Y-axis, 10 divisions = 50 μA.



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Result:-

Numerical Aperture (NA) of the given multimode optical fiber is 0.689 ~~(units)~~.