Date .....

Expt. No. 4 ..... Optical Fibre Page No. .....

Apparatus :-
- Diode Laser
- Optical fiber
- Laser-Fiber coupler
- Optical rail
- Pinhole photo detector
- Power supply for Laser and Detector output measurement unit

SLO :-

To determine numerical aperture of a 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.

$$\theta_a = \tan^{-1}(R/Z)$$

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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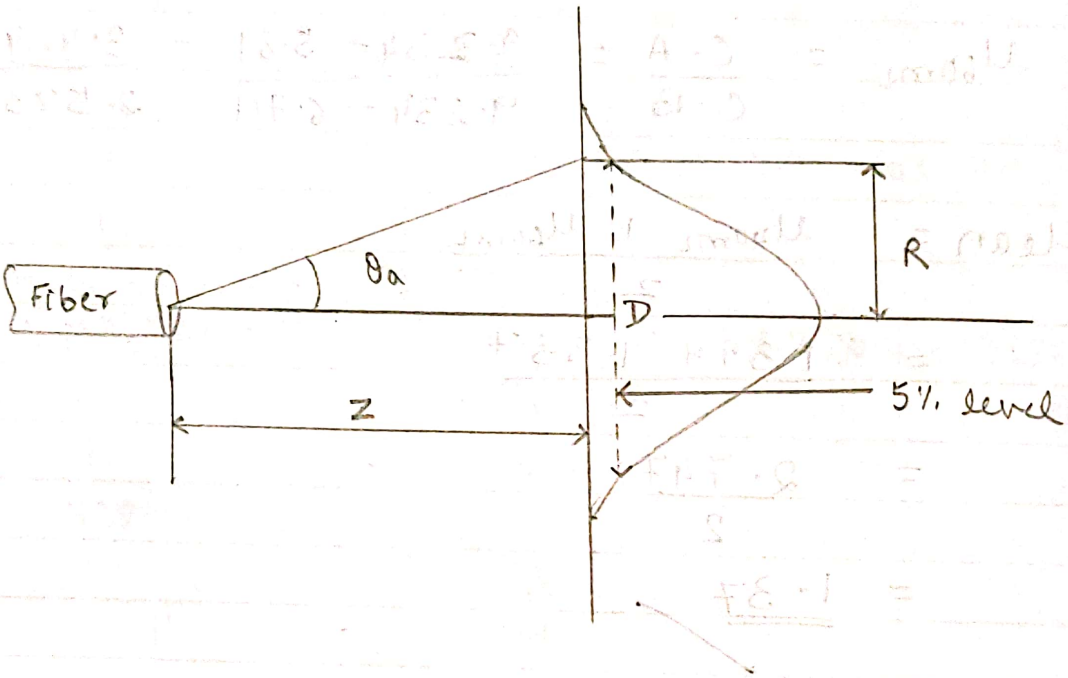
Fiber
θa
R
D
z
5% level

Z	Micrometer Reading (mm)	Detector Current	D
1mm	10	0.1	
	10.2	0.2	
	10.4	0.6	
	10.6	2.5	
	10.8	10.8	
	11	28.8	
	11.2	58.5	
	11.4	91.5	$2 \times R = D$
	11.6	108.4	$2 \times 0.9 = 1.8$ mm
	11.8	100.4	
	12	68.8	
	12.2	35.1	
	12.4	10.9	
	12.6	2.4	
	12.8	0.3	
	13	0.1	

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Calculation :-

$D = 1.8\,mm$

$\therefore R = \frac{D}{2} = 0.9\,mm$

$z = 1\,mm$

$\theta_a = \tan^{-1}\left(\frac{R}{z}\right) = \tan^{-1}\left(\frac{0.9}{1}\right) = 41.987^{\circ}$

$\therefore \sin\theta_a = 0.668$ ✓

Result :-

The acceptance angle of cone of optical fiber is ~~0.66~~ 41.987 and numerical aperture is 0.668.

10/10

31.1.25

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