Fig 8.1. Ray and current level diagram

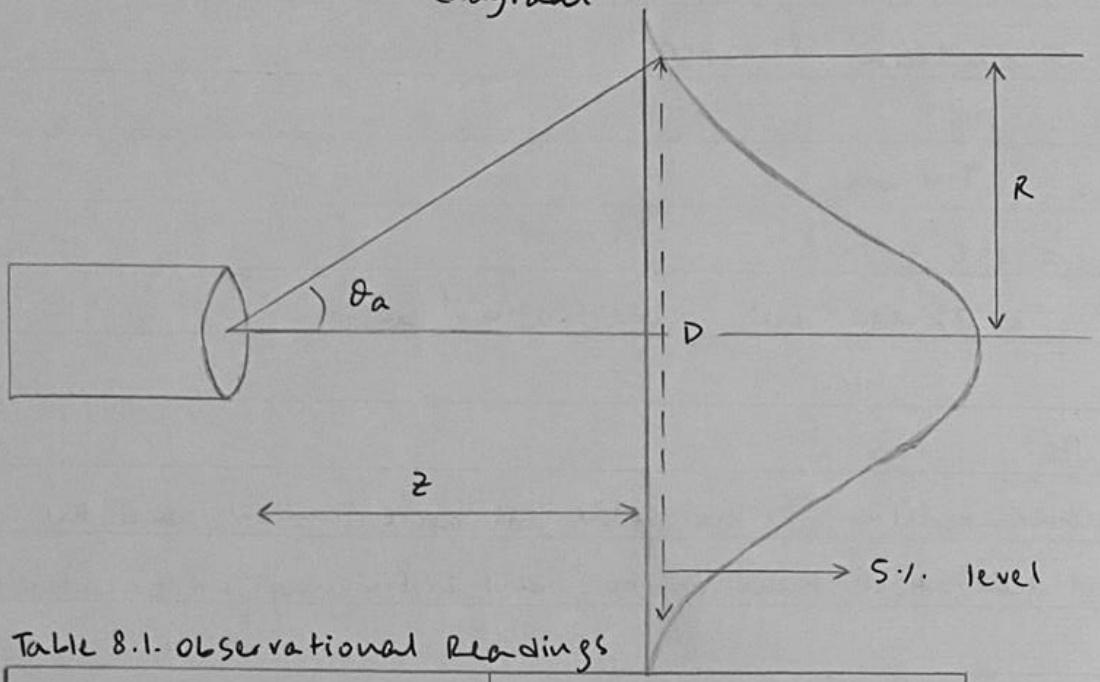

Table 8.1. Observational Readings

Micrometer Reading (mm)	Output current (mA)
12.2	0.1
12.4	0.1
12.6	0.2
12.8	0.3
13	0.9
13.2	3.7
13.4	14.5
13.6	42.5
13.8	72.2
14	110.6
14.2	96.5
14.4	71.6
14.6	26.5
14.8	5
15	0.8
15.2	0.3
15.4	0.2
15.6	0.1
15.8	0.1

Date

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Optical fiber characterisation

Apparatus Available:

Diode laser, optical fibre, Laser - Fiber coupler, Optical rail, pinhole photo detector, power supply for laser and detector output measurement unit.

Student Learning Objectives:

To determine the numerical aperature of a given multimode optical fiber.

Theory:

A multi-mode optical fiber will only propogate 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.

$$\theta_a = \tan^{-1}\frac{R}{z}$$, where D is the diameter of the 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.

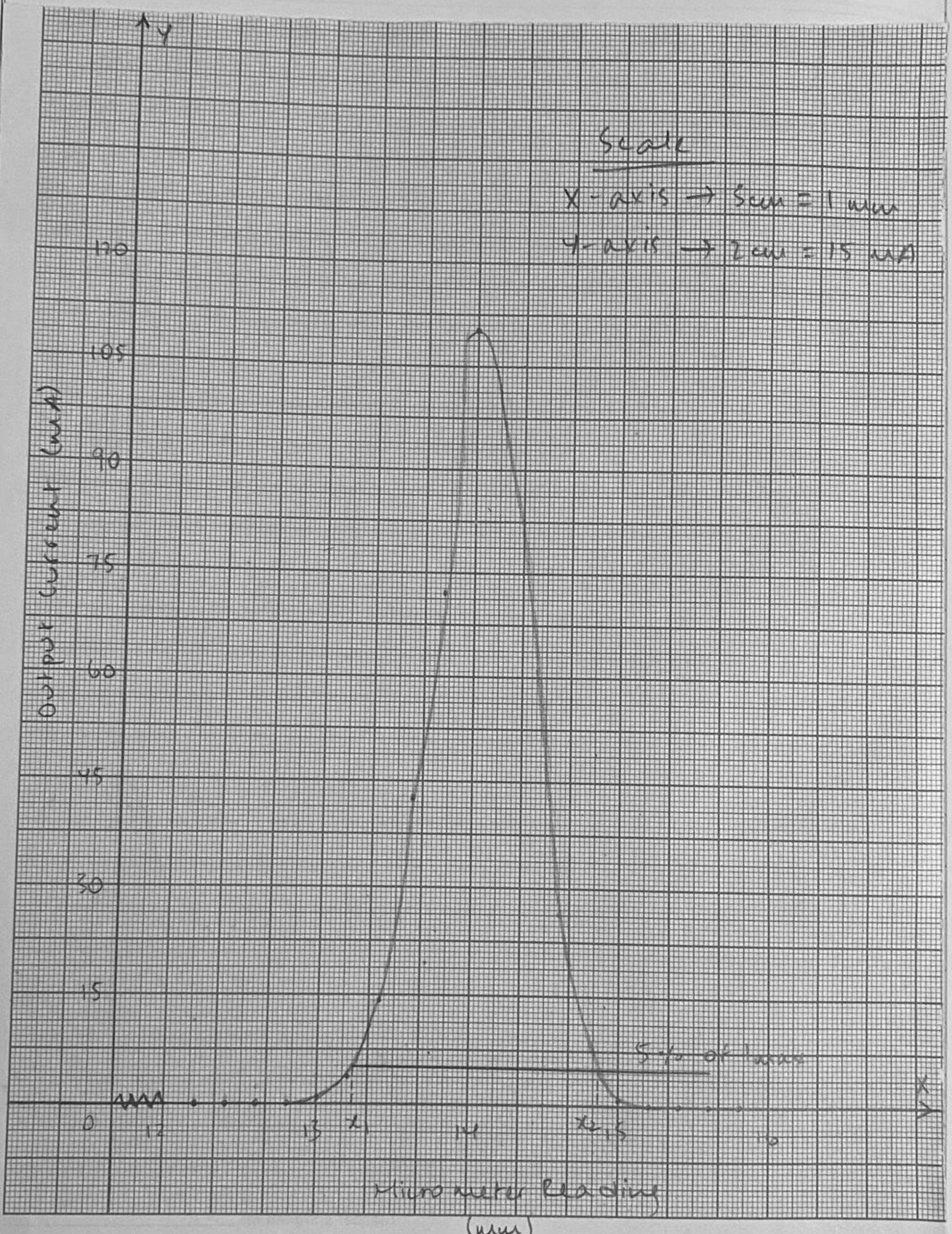
$$NA = \sin\theta_a$$

calculations:

$I_{max} = 110.6$

5% of $I_{max} = 5.53$

Teacher's Signature



Scale
X-axis → 5cm = 1 mm
Y-axis → 2 cm = 15 mA
Y
X
120
105
90
75
60
45
30
15
0
12
13
14
15
16
x_1
x_2
5% of Imax
Output Current (mA)
Micrometer Reading (mm)

$x_1 = 13.23$

$x_2 = 14.87$

$D = x_2 - x_1 = 1.64$

$R = D/2 = 0.82$

$\theta_a = \tan^{-1} R/z = 39.35$

Result:

Numerical Aperature of the given multimode optical fiber is 0.634.