Experiment 04
Laser based experiment I: Beam divergence

AIM: To measure the peak power and beam divergence of a given laser beam

APPARATUS: He-Ne laser, Optical bench, Laser Beam Analyzer with sensor and micrometerscrew arrangement.

Observation table 4.1 Powers at different positions at a distance $d1 = 50$ cm			Observation table 4.2 Powers at different positions at a distance $d2 = 100$ cm		
Sr. No.	Current in LBA, I (μA)	Position of micrometer x (mm)	Sr. No.	Current in LBA, I (μA)	Position of micrometer x (mm)
1	0	-0.1	1	0	-0.1
2	0	-0.075	2	0	-0.075
3	0	-0.050	3	0	-0.05
4	0	-0.025	4	0.03	-0.029
5	0.06	-0.015	5	0.04	-0.025
6	0.1	-0.011	6	0.06	-0.01
7	0.13	-0.008	7	0.08	-0.015
8	0.17	0	8	0.06	-0.025
9	0.13	0.008	9	0.08	0.01
10	0.10	0.011	10	0.06	0.015
11	0.06	0.015	11	0.04	0.025
12	0	0.025	12	0.03	0.029
13	0	0.050	13	0	0.050
14	0	0.075	14	0	0.075
15	0	0.08	15	0	0.08
16	0	0.1	16	0	0.1

Calculations:

$$\text{Divergence} = \frac{(D_2 - D_1)\ mm}{(d_2 - d_1)\ cm}$$

$$\frac{(D_2 - D_1)\ cm}{(d_2 - d_1)} \times 10^{-1}$$

$$= \mathbf{0.0005}\ rad$$

$$= 0.00056\ rad \quad * \quad \frac{180\ deg}{3.14\ rad}$$

$$= 0.028 deg$$

$$= 1.68 \text{min}$$

Table 4.3 Results

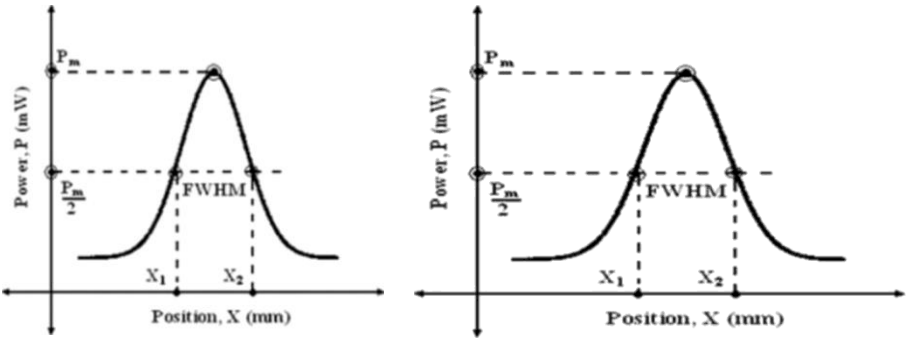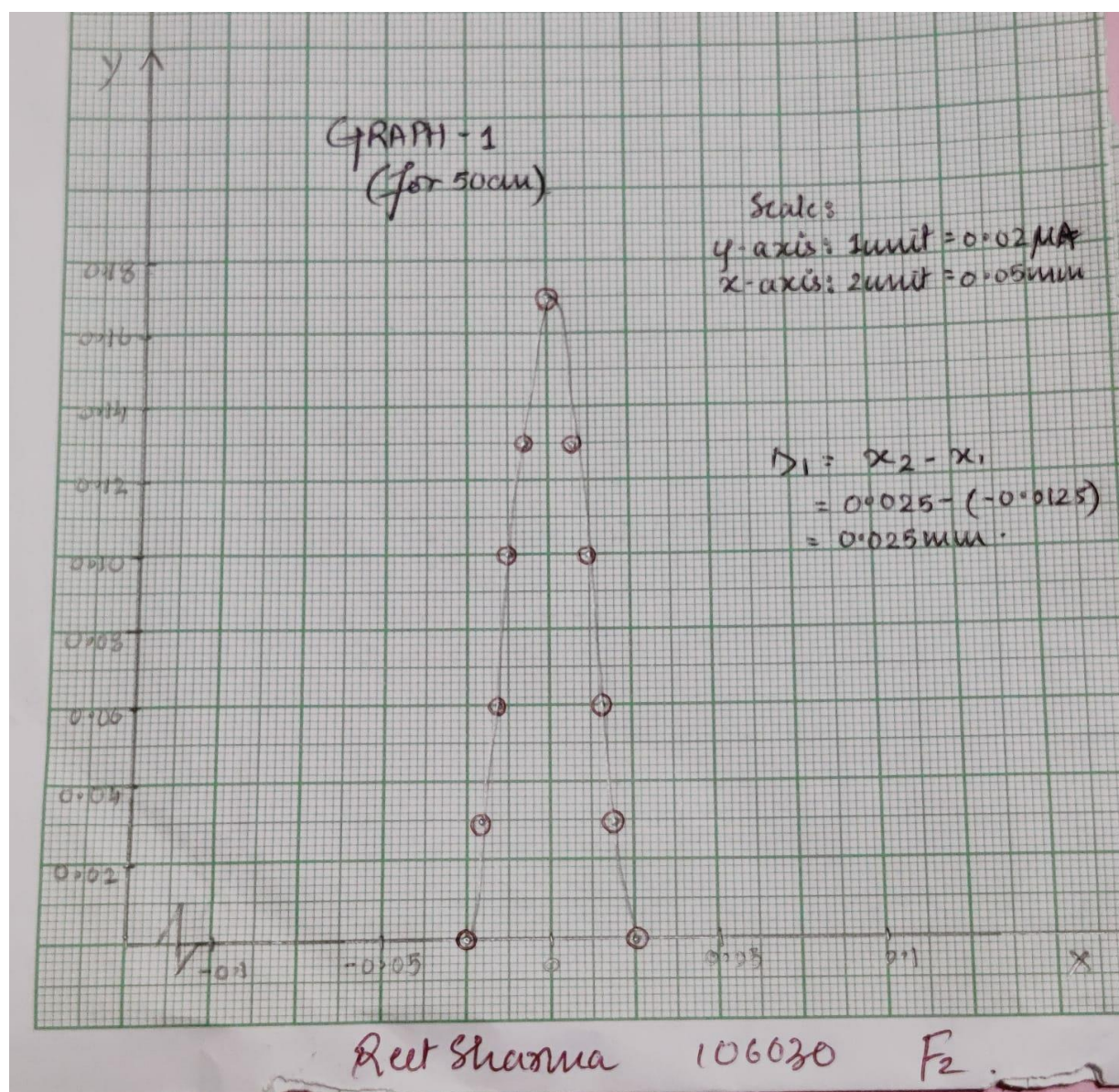| Sr. No.	Physlcal quantity	Value	Unit
1	Peak current the laser beam (at $d1=50$ cm)	0.17	mW
2	Divergence of laser beam	1.68	Min

Figure 4.3 Calculation of (a) diameter *DI* at position *d1 (b)* diameter *D2* at position *d2*

Model Graph-I for Expt. 4, Laser Beam Divergence

GRAPH - 1
(for 50cm)

Scale:
y-axis: 1unit = 0.02 μA
x-axis: 2unit = 0.05mm

$D_1 = x_2 - x_1$
$= 0.025 - (-0.0125)$
$= 0.025mm$

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Model Graph-II for Expt. 4, Laser Beam Divergence

GRAPH-2
(for 100cm).

Scale:
x-axis: 2units = 0.05mm
y-axis: 1unit = 0.02 μA

$D_2 = x_2 - x_1$

$= 0.025 - (-0.025)$

$= 0.05\ mm$

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