Gaussian Beam: Lesson Plan for 3-weeks

*Week-1:* **Introduction**

1. <https://www.youtube.com/watch?v=fW6olkXgBM8>

2. <https://www.youtube.com/watch?v=tmO3LK-YVzM>

***Interaction with Optical systems-1***

<https://www.youtube.com/watch?v=vreRlcbAAa0>

***Interaction with Optical systems-2***

<https://www.youtube.com/watch?v=Co_fLz4K3Ko>

***Measurement of Gaussian Beam***

<https://www.youtube.com/watch?v=9RRulxbQ9NQ>

***Week-2*: Advanced lecture & Doubt session**

Advanced Lecture (Optional)

<https://www.youtube.com/watch?v=MU4eOJw2sBQ>

* Write down a code for propagation of Gaussian beam
* Data analysis for calculating the divergence of a Gaussian beam (data will be supplied)

***Week-3*: Report writing and Viva**

Write your report in your own words. Submit the report and give viva

-------------------------------------------------------------------------------------------------------------------------

**Data for Gaussian beam propagation: Setup**

Lens **Z1 Z2 Z3 Z4**

**Laser beam Image captured in plane Z1**

A picture containing sign, beach, flying, sitting

Description automatically generated

**Laser beam Image captured in plane Z2**

A close up of a sign

Description automatically generated

**Laser beam Image captured in plane Z3**

Background pattern

Description automatically generated

**Laser beam Image captured in plane Z3**

Background pattern

Description automatically generated

**Experimental parameters:**

(i) Distance between successive planes is 25 cm,

(ii) The focal length of the lens is 3cm,

(iii) Diameter of collimated beam is approximately 2mm.

(iv) The laser is a red He-Ne laser of wavelength 632 nm.

(v) Laser powers are in micro watts to capture the profile.

**Suggestions for analysis:**

1. You may copy images in appropriate software for analysis.
2. The images have a scale bar (graph paper) which should be used to calibrate pixel of each image. Do not distort the images.
3. The intensity I(x) and I(y) for laser beam should be obtained from the line-cuts along horizontal and vertical directions which must be chosen at the centre of the spot.
4. Each image may have slightly different pixel calibration. Taken at optimized camera position.
5. Appropriate averaging procedure may be required to reduce noise in the image. Justify your approximations.
6. The data must be fitted with Gaussian functions and all the four images should be used to compute the divergence of a laser beam.
7. Estimate the waist of the laser beam at the focus?