**Department of Science and Humanities**

F Y B Tech SEM II 2021-22

Engineering Physics Lab Course

**Optical Fibre – Numerical Aperture (using photodetector)**

**Observation Table:**

LC of screw gauge = 0.01 mm

Type of optical fibre: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Light used: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Detector axial distance from the fibre (Z) = 2 mm

|  |  |  |
| --- | --- | --- |
| Sr. No | Screw gauge reading | Detector current (µA) |
| Main scale reading M (mm) | Matching division of circular scale (D) | Vernier reading V = D x LC (mm) | detector lateral distance(X) = M + V (mm) |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6\* |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| 11 |  |  |  |  |  |

\*This should be reading corresponding to peak current

Detector axial distance from the fibre (Z) = 4 mm

|  |  |  |
| --- | --- | --- |
| Sr. No | Screw gauge reading | Detector currentI (µA) |
| Main scale reading M (mm) | Matching division of circular scale (D) | Vernier reading V = D x LC (mm) | detector lateral distanceX = M + V (mm) |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6\* |  |  |  |  | IP =  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| 11 |  |  |  |  |  |

\*This should be reading corresponding to peak current

**Graph**:

Plot detector lateral distance X (on X-axis) v/s detector current (on Y-axis) for both the values of detector axial distance (Z) on the same graph paper

**Calculation:**

1. Determination of spot radius:
2. Find $\frac{1}{\sqrt{2}}$ value of the peak detector current (IP) = $\frac{I\_{P}}{0.71}$
3. These will be two values about the peak value (IP) as show in the diagram
4. Find the corresponding detector lateral distance values say X1 and X2
5. Spot radius (r) is calculated as $r=\frac{X\_{2}-X\_{1}}{2}$
6. Determination of numerical aperture (NA):

$$NA=\frac{r}{\sqrt{r^{2}+Z^{2}}}$$

1. Determine acceptance angle (θ):

$$θ=sin^{-1}NA$$

**Result:**

Numerical Aperture of the optical fibre NA = \_\_\_\_\_\_\_\_\_\_

Acceptance angle θ = \_\_\_\_\_\_\_\_\_\_



**Home Assignment**:

Determine NA using light of different colour for any one value of detector axial distance Z. Hence conclude whether NA is dependent or independent on the wavelength of light used.

**Observation table for home assignment:**

Type of optical fibre: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (same as that in the experiment)

Light used: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (different than that in the experiment)

Detector axial distance from the fibre (Z) = 2 mm

|  |  |  |
| --- | --- | --- |
| Sr. No | Screw gauge reading | Detector current (µA) |
| Main scale reading M (mm) | Matching division of circular scale (D) | Vernier reading V = D x LC (mm) | detector lateral distance(X) = M + V (mm) |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6\* |  |  |  |  | IP =  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
| 11 |  |  |  |  |  |

\*This should be reading corresponding to peak current

**Result:**

Numerical Aperture of the optical fibre NA = \_\_\_\_\_\_\_\_\_\_

Acceptance angle θ = \_\_\_\_\_\_\_\_\_\_

**Conclusion:**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.