CAPA - 8 Problem-4

4. A set of narrow vertical slits is located a distance D from the screen. The slits are equally spaced and have the same width. The intensity pattern in the figure is observed when light from a laser passes through the slits, illuminating them uniformly. The screen is perpendicular to the direction of the light. Calculate the slit width. Given Distance to the screen = 2.95 m; Wavelength of light = \(0.47 \times 10^{-6}\) m; Distance between the tick marks on the intensity figure = 1.4 cm

**SOLN:** The central pattern can be seen as a diffraction pattern from a single slit repeating itself. Estimate the first minimum for such pattern. This would be approximately \(x = 5 \Delta x = 5 \times 1.4 = 7.0\) cm

The angle \(\theta\) can be found as

\[
tan(\theta) = \frac{x}{L} = \frac{0.07}{2.95} \quad \theta = 1.359^\circ
\]

For the first minimum \(m = 1\) for single slit diffraction

\[
a \sin \theta = m \lambda
\]

\[
a = \frac{m \lambda}{\sin \theta}
\]

\[
a = \frac{1 \times 0.47 \times 10^{-6}}{\sin(1.359)} = 19.81 \mu m
\]