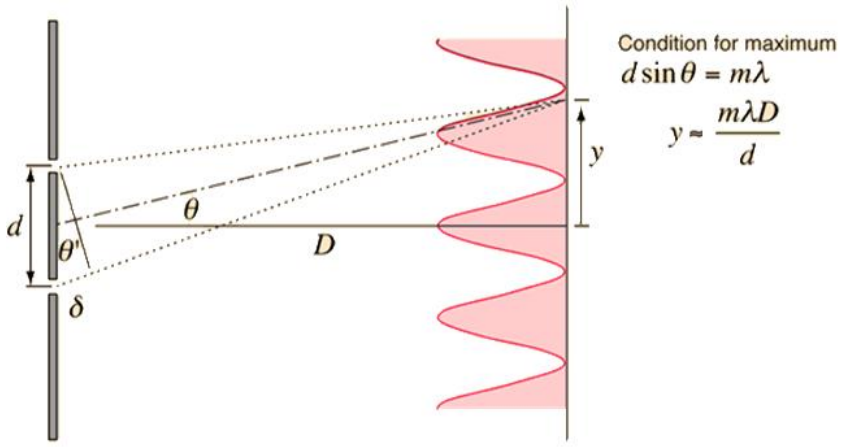
Answer on Question#40905, Physics, Optics

In YDSE, the slits are 2 mm apart and are illuminated by photons of 2 wave length 12000 Å and 10000 Å. At what minimal distance from the common central bright fringe on the screen 2 m from the slit will a bright from one interference pattern coincide with bright fringe from other ?

Solution:



The condition for maximum (bright spot) is

$$d \sin\theta = m\lambda$$

where m is order of interference, D = 2 m, d = 2.0×10^{-3} m.

Here as we are considering the coincidence of two bright fringes, that is why the value of $\sin\theta$ will be the same for both.

Let m_1 is order of bright fringe for 12000 Å and m_2 is order of bright fringe for 10000 Å, and they will coincide.

$$d \sin\theta = m_1\lambda_1$$
$$d \sin\theta = m_2\lambda_2$$
$$m_1\lambda_1 = m_2\lambda_2$$
$$\frac{m_2}{m_1} = \frac{\lambda_1}{\lambda_2} = \frac{12000}{10000} = \frac{6}{5}$$

So we can say that for minimum distance bright fringe number 6 for 10000 Å will coincide with bright fringe number 5 or 12000 Å

The distance between two adjacent bright spots on the screen is

$$y \approx \frac{m\lambda D}{d}$$

where m is order of interference, D = 2 m, d = 2.0×10^{-3} m.

Thus,

$$y = \frac{6 \cdot 10000 \cdot 10^{-10} \cdot 2}{2 \cdot 10^{-3}} = 0.006 \text{ m} = 6 \text{ mm}$$

Answer. 6 mm.