

Q- In Young's interference experimental arrangement, the incident yellow light is composed of two wavelengths  $5890 \times 10^{-10}$  m and  $5895 \times 10^{-10}$  m. The distance between the slits is  $10^{-3}$  m and the screen is placed 1 m away. Up to what order can fringes be seen on the screen and how far from the center of the screen does this occur?

**Sol.** In Young's double slit experiment the fringe width is given by

$$\beta = \frac{D\lambda}{d}$$

Here D is the distance of screen, d is the width of the slit and  $\lambda$  is the wavelength of light.

The fringe patterns of the two waves will overlap and the resultant intensity will be seen on the screen. If the intensity of the light is nearly uniform everywhere the fringe pattern will disappear. The fringes will be invisible when the  $n^{\text{th}}$  maximum of wavelength  $5895 \text{ \AA}$  coincides with the  $(n + 1/2)$  minimum of wavelength  $5890 \text{ \AA}$ . Hence,

$$n \beta = (n + \frac{1}{2}) \beta'$$

or 
$$n \lambda = (n + \frac{1}{2}) \lambda'$$

$$n (5895) = (n + \frac{1}{2}) 5890$$

Solving we get  $n = 589$

So, the fringes will be visible up to the order 589.

Distance from the centre is given by

$$\begin{aligned} x &= \frac{n\lambda D}{2d} = \frac{589 \times 5895 \times 10^{-10} \times 1}{10^{-3}} \\ &= 0.347 \text{ m} \end{aligned}$$