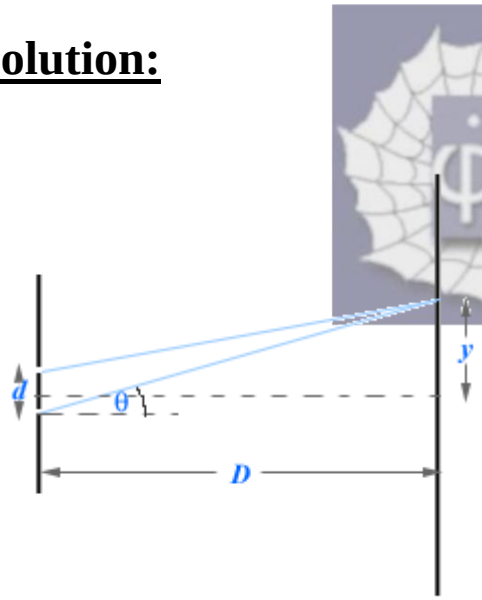
629.

Problem 45.3 (RHK)

A double-slit experiment is performed with blue-green light of wavelength 512 nm. *The slits are* 1.2 mm *apart and the screen is* 5.4 m *from the slits. We have to find the distance between the bright fringes as seen on the screen.*

Solution:



In the Young's double-slit, the condition for interference maxima at small angles is

$$d\sin\theta = m\lambda, \text{ for } m = 0,1,2,3,..$$

As angle θ is small, we approximate

$$\sin\theta\ ;\ \theta = \frac{y}{D},$$

where y is the distance on the screen of the interference maxima from the midpoint of the interference pattern, and D is the distance of the screen from the slits. Therefore, the distance between the successive bright fringes will be

$$\Delta y = \frac{\lambda D}{d}.$$

We use the data of the problem;

$\lambda = 512 \text{ nm} = 512 \times 10^{-9} \text{ m},$

$D = 5.4 \text{ m}, \text{ and}$

$d = 1.2 \text{ mm} = 1.2 \times 10^{-3} \text{ m}.$

We find

$$\Delta y = \frac{512 \times 10^{-9} \times 5.4}{1.2 \times 10^{-3}} \text{ m} = 2.3 \text{ mm}.$$