665.

Problem 46.31 (RHK)

Two slits of width a and separation d are illuminated by a coherent beam of light of wavelength λ. *We have to find the linear separation of the interference fringes observed on a screen that is a distance D away*.

Solution:

Let us consider a Young's double-slit of slit separation *d*. The condition for interference maxima of a Young's double-slit is

$$d\sin\theta = m\lambda,\ m = 0, \pm 1, \pm 2, \ldots$$

Assuming that the distance of the screen from the slits D ? d, we approximate

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

where *y* is the distance of a fringe from the central fringe.

We thus note the linear difference between successive fringes will be given as

$$\frac{y_{m+1} - y_m}{D} = \frac{\lambda}{d},$$

and

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

In the above analysis we have considered fringes that are contained within a diffraction lobe.