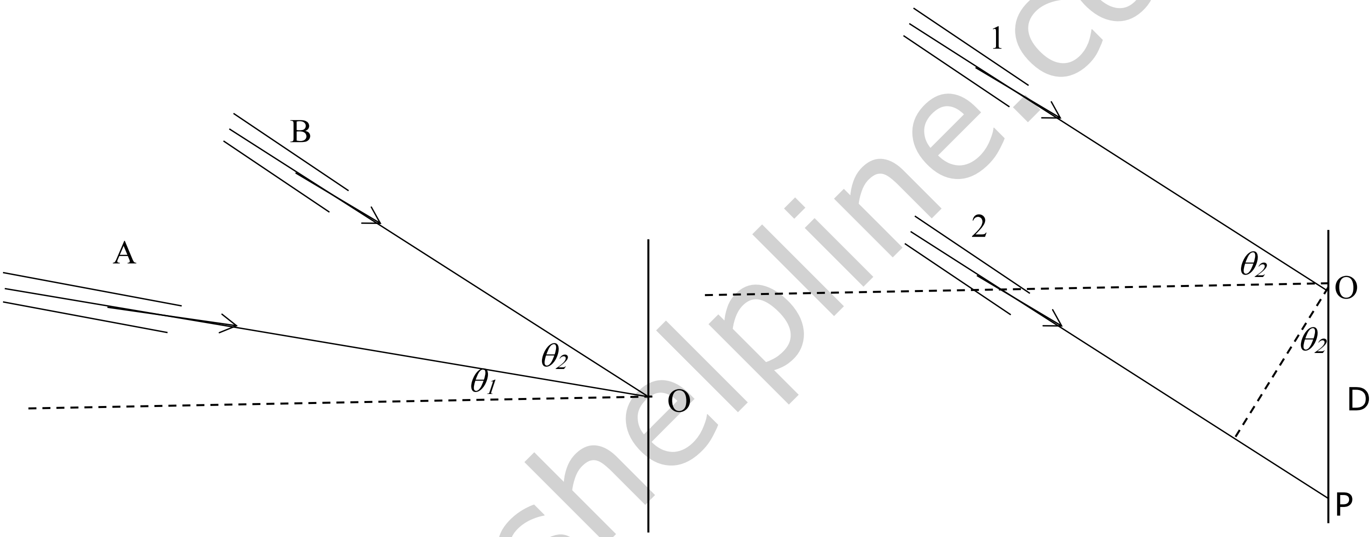
Q- Two identical thin, parallel and coherent beams of same intensity and wavelength λ are incident on a screen lies in the same plane at angles θ_1 and θ_2. with the normal. Find the fringe width on the screen.

The two beams A and B are incident on the screen and say the two rays of the at point O are in same phase at point O. If the rays are in same phase at O, the intensity of light is maximum at this point and is called a maxima.

Now consider two rays 1 and 2 of beam B are incident at point O and P on the screen at distance D.



The path difference between the two rays 1 and 2 can be calculated by drawing a perpendicular OM from O on beam 2. The length MP is the path difference and is given by considering triangle OPM as

$$\delta_2 = OP\sin\theta_2 = D\sin\theta_2$$

Similarly, the path difference between two rays of beam A incident at O and P will be

$$\delta_1 = OP\sin\theta_1 = D\sin\theta_1$$

As the two beams are coherent, the net path difference between the two rays will be

$$\delta_2 - \delta_1 = D\,(\sin\theta_2 - \sin\theta_1)$$

Now there is a maxima at O the phase difference is zero of path difference can be considered zero. For the next maxima the phase difference should be 2π and the path difference must be λ.

Thus next maxima will be at P if the path difference is

$$\delta_2 - \delta_1 = D\,(\sin\theta_2 - \sin\theta_1) = \lambda$$

Or $$D = \frac{\lambda}{\sin\theta_2 - \sin\theta_1}$$

As the distance between two consecutive maxima (or minima) is called fringe width, the fringe width is given by

$$\beta = \frac{\lambda}{\sin\theta_2 - \sin\theta_1}$$