631.
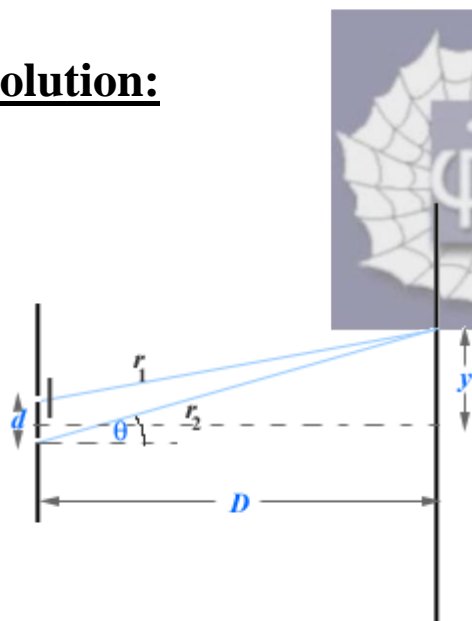
A thin flake of mica $(n=1.58)$ is used to cover one slit of a double-slit arrangement. The central point on the screen is occupied by what used to be the seventh bright fringe. If $\lambda = 550$ nm, we have to find the thickness of the mica.

Solution:

In the absence of the mica sheet the position of the seventh bright fringe is given by the condition that

$r_2 - r_1 = 7\lambda.$

Let the thickness of the mica sheet be x m. The refractive index of mica is

$n = 1.58.$

When the mica sheet is inserted as shown in the figure, the optical path corresponding to ray r_1 gets changed to

$r_1 + nx - x.$

It is given that after the mica sheet has been inserted, the central point on the screen is occupied by what used to be the seventh bright fringe. Therefore, we have

$r_1 + nx - x = r_2,$

or

$$x = \frac{(r_2 - r_1)}{(n-1)} = \frac{7\lambda}{1.58 - 1} = \frac{7 \times 550 \times 10^{-9}}{0.58} \text{ m}$$

$$= 6.64 \ \mu\text{m}.$$