3. A beam of light consisting of two wavelengths, 650 nm and 520 nm, are used to obtain interference fringes in a Young's double slit experiment.

a. Find the distance of the third bright fringe on the screen from the central maximum for wavelength 650 nm.
b. What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide?

Sol. Here, $\lambda_1 = 650\ nm = 650 \times 10^{-9} m$
$\lambda_2 = 520\ nm = 520 \times 10^{-9} m$
Suppose, d = distance between two slits
D = Distance of screen from the slits

a. For third bright fringe, n = 3
$x = n\ \lambda_1 \cdot \frac{D}{d}$
$= 3 \times 650 \times \frac{D}{d} = 1950 \frac{D}{d}$
b. Let nth bright fringe due to wavelength 650 nm coincide with (n -1)th due to wavelength 520 nm.
Therefore, $n\ \lambda_2 = (n-1)\lambda_1$
or, $n \times 520 = (n-1) \times 650 \Rightarrow n = 5$
Hence, the least distance from the central maximum can be obtained by the relation:
$x = n\lambda_2 \frac{D}{d} = 5 \times 520 \frac{D}{d} = 2600 \frac{D}{d}\ nm$
Note: The value of d and D are not given in the question.