3. A thin film of oil (refractive index 1.25) is floated on a thick glass plate (refractive index 1.50). Plane light waves of variable wavelength are incident normal to the film. When one views the reflected wave it is noted that complete destructive interference occurs at 6000 A and constructive interference at 7000 A.

Calculate the thickness of the oil film.

\[ \pi \text{ phase shift because } n_1 < n_2 \]

\[ \pi \text{ phase shift because } n_2 < n_3 \] (5)

For const. int. at 7000 A

The optical path difference \( 2n_2d \) must be an integral number of wavelengths.

\[ 2n_2d = m \times 7000 \text{A} \] (8)

and for 6000 A

\[ 2n_2d = (m+\frac{1}{2}) \times 6000 \text{A} \]

Equate equal path differences:

\[ m \times 7000 = (m+\frac{1}{2}) \times 6000 \] (3)

or \[ \frac{2m}{2m+1} = \frac{6000}{7000} \]

The lowest integer, \( m \), is 3.

Then

\[ d = \frac{m \times 7000}{2n_2} = \frac{3 \times 7000}{2(1.25)} \]

= 8400 A