Physics of Waves

PH11003

Tutorial 7

Topic : Interference

6 January 2023

[7.1] A plane monochromatic light wave falls normally on a diaphragm with two narrow slits separated by a distance d = 2.5 mm. A fringe pattern is formed on a screen placed at a distance l = 100 cm behind the diaphragm. By what distance and in which direction will these fringes be displaced when one of the slits is covered by a glass plate of thickness h = 10 um?

[7.2] Find the minimum thickness of a film with refractive index 1.33 at which light with wavelength 0.64 um experiences maximum reflection while light with wavelength 0.40 um is not reflected at all. The incidence angle of light is equal to 30Â°..

[7.3] The ratio of the amplitudes of two beams forming an interference fringe pattern is 2/1. What is the visibility? What ratio of amplitudes produces a visibility of 0.5?

[7.4] Two slits are illuminated by light that consists of two wavelengths. One wavelength is known to be 436 nm. On a screen, the fourth minimum of the 436-nm light coincides with the third maximum of the other light. What is the wavelength of the other light?

[7.5] Suppose a monochromatic coherent source of light passes through three parallel slits, each separated by a distance d from its neighbor. The waves have the same amplitude E_0 and angular frequency ω, but a constant phase difference $\phi = 2\pi dsin\theta/\lambda$. (a) Show that the intensity is

$$I = \frac{I_0}{9}[1 + 2cos(\frac{2\pi dsin\theta}{\lambda})]^2$$

where I_0 I is the maximum intensity associated with the primary maxima. (b) What is the ratio of the intensities of the primary and secondary maxima?

Answer Keys