

PHYS 452 Homework Chapter 9

Name (print): _____

Signature _____

Problem 1 _____

Problem 2 _____

Problem 3 _____

Problem 4 _____

Problem 5 _____

Total _____

Directions: You know the drill.

Problem 1. A collimated beam of mercury green light at 546.1 nm is normally incident on a slit 0.015cm wide. A lens of focal length 60 cm is placed behind the slit. A diffraction pattern is formed on a screen placed in the focal plane of the lens. Determine:

- The distance between the central maximum and the first minimum
- The distance between the first and second minima

Problem 2. In a Young's experiment, narrow double slits 0.2 mm apart diffract monochromatic light onto a screen 1.5 meters away. The distance between the 5th minima on either side of the zeroth order maximum is 34.73 mm. What is the wavelength of light passing through the slits?

Problem 3. Light of continuously variable wavelength illuminates normally a thin oil ($n = 1.30$) film on a glass surface. Extinction of the reflected light is observed to occur at only two wavelengths, 525 and 675 nm. Determine the thickness of the oil film and the orders of the interference.

Problem 4. A thin liquid film, having a refractive index of $n_f = 1.6$, is deposited on a plexiglass plate ($n_{pg} = 1.4$) until the film has the minimum non-zero thickness necessary to produce maximum intensity reflections for $\lambda = 700$ nm light which comes from air and strikes the surface of the film at normal incidence. Determine:

- The mean thickness of the film
- The reason that the edges of the film (where it thins out) appear black.

Problem 5. Two beams having parallel electric fields are described by:

$$E_1 = 3 \sin\left(k_1 \cdot r - \omega t + \frac{\pi}{5}\right)$$

$$E_2 = 4 \sin\left(k_2 \cdot r - \omega t + \frac{\pi}{6}\right)$$

The beams interfere at a point where the phase difference due to path difference is $\pi/3$ (the first beam having the longer path). Compute:

- The irradiances I_1 and I_2
- The irradiance of the two combined beams I_{12}