Chapter 33, 34, 35, 36 Tutorial

Optics-I, II, III, IV

Chapter 33 : The Nature and Propagation of Light

Chapter 34: Geometric Optics

Chapter 35: Interference

Question 1:

Light traveling in air is incident on the surface of a block of plastic at an angle of 62.7° to the normal and is bent so that it makes a 48.1° angle with the normal in the plastic. Find the speed of light in the plastic.

Question 2: Coherent sources A and B emit electromagnetic waves with wavelength 2.00 cm. Point P is 4.86 m from A and 5.24 m from B. What is the phase difference at P between these two waves?

Question 3: Two light sources can be adjusted to emit monochromatic light of any visible wavelength. The two sources are coherent, 2.04μ m apart, and in line with an observer, so that one source is 2.04μ m farther from the observer than the other.

   (a) For what visible wavelengths (380 to 750 nm) will the observer see the brightest light, owing to constructive interference?
   (b) How would your answers to part (a) be affected if the two sources were not in line with the observer, but were still arranged so that one source is 2.04μ m farther away from the observer than the other?
   (c) For what visible wavelengths will there be destructive interference at the location of the observer?

Question 4: (36.47) Observing Jupiter. You are asked to design a space telescope for earth orbit. When Jupiter is 5.93×10^8 km away (its closest approach to the earth), the telescope is to resolve, by Rayleigh's criterion, features on Jupiter that are 250 km apart. What minimumdiameter mirror is required? Assume a wavelength of 500 nm.

Question 5: Monochromatic light with wavelength $\lambda = 620$ nm passes through a circular aperture with diameter 7.4 μm. The resulting diffraction pattern is observed on a screen that is 4.5 m from the aperture. What is the diameter of the Airy disk on the screen?

Question 6: A camera lens has a focal length of 200 mm. How far from the lens should the subject for the photo be if the lens is 20.4 cm from the film?

Question 7: State laws of reflection and refraction.

Question 8: A beam of light has a wavelength of 650 nm in vacuum. (a) What is the speed of this light in a liquid whose index of refraction at this wavelength is 1.47? (b) What is the wavelength of these waves in the liquid?

Question 9: A coin is placed next to the convex side of a thin spherical glass shell having a radius of curvature of 18.0 cm. Reflection from the surface of the shell forms an image of the $1.5 -$ cm-tall coin that is 6.00 cm behind the glass shell. Where is the coin located? Determine the size, orientation, and nature (real or virtual) of the image.

Question 10:

Parallel rays of green mercury light with a wavelength of 546 nm pass through a slit covering a lens with a focal length of 60.0 cm. In the focal plane of the lens the distance from the central maximum to the first minimum is 10.2 mm. What is the width of the slit?