Department of Physics

Electrodynamics and Optics (PH005)

Tuturial 4 (October 16 , 2019)

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(1) Two coherent beams of wavelength 5000 $\mathring{A}$ reaching a point would individually produce intensities 1.44 and 4.0 units respectively. If these beams interfere at that point, the intensity is 0.9 unit. Calculate the phase difference with which the beams reach that point.

(2) In a young slit experiment, an thin slab of transparent material is placed in front of one of the slit. zeroth order maxima shift to the position of 4th order maxima (before placing slab). refractive index of thin slab is=1.2. Calculate thickness of the film. Wavelength used in the experiment is equal to 5000 $\mathring{A}$

(3) A lens is coated with thin film to reduce the reflection. Refractive indexes of thin film and lens are 1.2 and 1.5 respectively. Calculate the thickness of thin film corresponding to minimum reflection considering wavelength of 500 nm.

(4) Line width($\Delta\lambda$) of light ($\lambda = 5000\,\mathring{A}$) from a monochromator is equal to $2 \times 10^{-1}\,\mathring{A}$. Calculate largest path difference for which interference fringes are visible.

(5) If a slit illuminated by sodium light (5893 $\mathring{A}$) is placed at 0.15 cm from the plane of the Lloyd's mirror. What will be the distance between consecutive maxima formed on a screen at 1 m from the slit.

(6) Two rectangular pieces of plane glass are placed on top of each other and a thin wire is placed between them at one edge so that think wedge of air is formed. The plates are illuminated with light ($\lambda = 5893\,\mathring{A}$) at normal incidence. Bright and dark fringes are formed, there being 10 of each per cm. Length of the wedge measured normal to the edge in contact. Find the angle of the edge.

(7) If the angle of the wedge is 0.25° of an arc and the wavelengths of sodium lines are 5890 $\mathring{A}$ and 5896 $\mathring{A}$. FInd the distance from tip of the edge at which the maximum to each wavelength first coincide.

(8) A parallel beam of red light ($\lambda = 700$ nm) incident on a soap film of thickness t at an 30° to the normal give second order constructive interference. Considering refractive index of light equal to 1.33, calculate the thickness of soap film.

(9) In a double slit experiment fringes are produced using wavelength of 4800 $\mathring{A}$. One slit is covered with a thin plate of glass with refractive index of 1.4 and other slit by another plate of glass with same thickness but having 1.7 refractive index. Now central bright fringe shifts to the position originally occupied by the fifth bright fringe. Calculate thickness of the glass plate.

(10) The intensities of the maxima and minima of an interference pattern are in the ratio of 16:9. Calculate the ratio between the amplitudes and intensities of the two interfering waves.

(11) When a crystal of 1.5 refractive index has a thin film with 1.5 refractive index. Considering normal incidence, calculate thickness of film which gives a) maximum b) minimum reflection of light with $5000\,\mathring{A}$

(12) Calculate the distance at which a source of diameter 1 mm should be kept from a screen so that two points separated by a distance of 0.5 mm may be said to be coherent. Assume $\lambda = 6000\,\mathring{A}$

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