Department of Physics

Electrodynamics and Optics (PHN-005)

Tuturial 5 (November 3 , 2019)

(1) Newton's rings are formed by light reflected normally from a plano-convex lens and a plane glass plate with a liquid between them . The diameter of the n^{th} and $(n+10)^{th}$ rings are 2.18 and 4.51 mm respectively. Calculate the refractive index of the liquid. Value of the light wavelength is 5893 $\mathring{A}$ and radius of curvature of the used lens is equal to 90 cm.

(2) A convex lens (radius of curvature =30 cm) is placed on the top of a glass plate and illuminated at normal incidence with red light (λ=650 nm). Newton's rings are observed. Calculate diameter of 3^{rd} bright ring.

(3) A Newton's ring arrangement is used with a source emitting two wavelengths $\lambda_1 = 6000\,\mathring{A}$ and $\lambda_2 = 4500\,\mathring{A}$. It is found that the n^{th} dark ring due to λ_1 coincides with $(n+1)^{th}$ for λ_2. FInd the diameter of n^{th} ring for λ_1. Radius of the curvature is 90 cm.

(4) A convex lens of 20 cm is placed after a slit of width 0.6 mm. If a plane wave of wavelength 600 nm falls normally on the slit, calculate the separation between the second minima on either side of the central maximum. Also calculate the ratio of the intensity of the central maximum to first maxima.

(5) Assuming that the resolving power of the eye is determined by diffraction effects only, calculate the maximum distance at which two objects separated by a distance of 2 m can be resolved by the eye.(Assume pupil diameter 2 mm and λ=6000, $\$\mathring{A}$.

(6) Calculate the Fraunhofer diffraction pattern produced by a double slit arrangement with slits of width b and $3b$, with their centers separated by a distance $6b$.

(7) A parallel laser beam with a diameter of 2 mm and a power of 10 W falls on a convex lens of diameter 25 mm and focal length 10 mm. If the wavelength of of the laser beam is 500 nm, estimate the average intensity at the focussed spot.

(8) A circular aperture of radius 0.01 cm is placed in front of the convex lens of focal length of 25 cm and illuminated by a parallel beam of light of 500 nm wavelength. Calculate the radii of the first three dark rings.

(9) Calculate the diameter of a telescope lens if a resolution of of 0.1 arc seconds is required at λ=600 nm.

(10) Estimate linear separation of two objects on the surface of the moon that can be resolved by an observer on the earth using eye of 5 mm pupil diameter. Assume wavelength as 550 nm and earth moon distance as 3.8×10^8 m.
