Problem Set-9

PH11001 (Spring 2019-20)

Optics: Interference, Diffraction.

March 30, 2020

1. *Fizeau fringes*

   A plane monochromatic light wave with a wavelength λ falls on the surface of a glass wedge of refractive index n. The angle of the wedge $\alpha << 1^\circ$. The plane of incidence is normal to the edge and the angle of incidence is θ_1. Find the distance between neighbouring fringe maxima on a screen placed at right angles to the reflected light.

2. *Newton's rings*

   The spherical surface of a plano-convex lens comes into contact with a glass plate. The space between the lens and the plate is filled up with a transparent liquid. The refractive indices of the lens, liquid and plate are given by: $n_1 = 1.5; n_2 = 1,63; n_3 = 1.70$ respectively. The radius of curvature of the spherical lens is equal to R = 100 cm. Find the radius of the fifth dark Newton's ring in reflected light of wavelength $\lambda = 0.50\ \mu m$.

3. *Thin film interference*

   A soap film of thickness 5.5×10^{-5} cm is viewed at an angle of 45°. Its index of refraction is 1.33. Find the wavelength of light in the visible spectrum which will be absent from the reflected light.

4. *Single slit diffraction*

   The distance between the first and fifth minima of a single-slit diffraction pattern is 0.35 mm, with the screen 40 cm away from the slit, and light of wavelength 550 nm. Find the slit width.

5. *Diffraction grating*

   Find the wavelength of monochromatic light falling normally on a diffraction grating with period $d = 2.2\ \mu m$, if the angle between the directions to the Fraunhofer maxima of the first and the second order is equal to $\Delta\theta = 15^\circ$.