Physics-1 : Tutorial Set-8

PH11001 (Spring 2019-20)

March 16, 2020

1. (a) Looking into a Michelson interferometer one sees a dark central disk surrounded by concentric bright and dark rings. One arm of the device is 2 cm larger than the other, and the wavelength of the light is 500 nm. Determine (i) the order of the central disc and (ii) the order of the 6th dark ring from the center.

   (b) In an experiment with Michelson interferometer, the distance travelled by the mirror for two successive positions of maximum distinctness is 0.2945 mm. If the mean wavelength for the two components of the source is 548.3 nm, calculate the difference between the two wavelengths.

2. One beam of interferometer passes through a small glass container containing a cavity 1.30 cm deep. When a gas is allowed to slowly fill the container, a total of 186 dark fringes are counted to move past a reference line. The light used has a wavelength of 610 nm. Calculate the index of refraction of the gas at its final density, assuming that the interferometere is in vacuum.

3. (a) A glass plate of n_g=1.5 is coated with a polymer film of n_f=2. Calculate the coating thickness so as to observe (i) maximum and (ii) minimum reflection using a light of wavelength λ=500 nm.

   (b) Diffuse Monochromatic light with λ=0.6 μm falls on a thin film of refractive index n_g=1.5. Determine the film thickness if the angular separation of neighboring maxima observed in reflected light at angles close to 45 degrees to the normal is equal to $\delta\theta$=2.0 degrees.

4. (a) Under the influence of gravity, a wedge-shaped film is formed when a metal is vertically dipped inside a soapy solution (n=1.34). A coherent and monochromatic light of wavelength λ=488 nm falls near-normally on this wedge. The experimentalist observes 12 fringes per

cm. Determine the wedge angle of the soap film.

5. (a) A Newton's ring apparatus (comprising of a spherical surface of radius 1 m) is illuminated by light with two wavelength components. One of the wavelengths is 546 nm. If the 11th bright ring is of 546 nm fringe system coincides with the 10th ring of the other, (i) what is the second wavelength? (ii) what is the radius at which overlap takes place and the thickness of the air-film there?

   (b) When a Newton's ring apparatus is immersed in a liquid, the diameter of the eigth dark ring decreases from 2.92 cm to 2.60 cm. What is refractive index of the liquid?