

Tutorial - 2

1. Consider a point P on the screen of the Young's double slit experiment such that $S_2P - S_1P = \lambda/3$. Find the ratio of the intensity at that point to that at maximum. Where S_1 & S_2 are the two slits and λ is wavelength of the light used. Ans. $1/4$
2. In a double slit interference arrangement one of the slit is covered with a thin mica sheet whose refractive index is 1.58. The distance between S_1 and S_2 is 0.1 cm while the distance between slit and screen is 50 cm. due the introduction of the mica sheet the central fringes get shifted by 0.2 cm. Determine the thickness of the mica sheet. Ans. 6.4×10^{-4} cm
3. The inclined faces of a glass biprism ($\mu=1.5$) makes angles of 1° with the base of the prism. The slit is 0.1 m from the biprism and is illuminated by light of $\lambda = 5900 \text{ \AA}$, find the fringe width observed at a distance of 1 m from the biprism. Ans. 37×10^{-5} m
4. In a Fresnel's biprism experiment the fringe width observed is 0.087 mm. What it will become if the slit to biprism distance is reduced to 0.75 times original distance?
Ans. 0.116mm
5. A disabled tanker leaks kerosene ($n= 1.20$) in to the bay of bangal, creating a large slick on the top of the water ($n= 1.30$). (A) If you are looking at straight down from an airplane, while sun is over-head, at a region of the slick where its thickness is 380 nm, which color (s) the film will appears to you. (B) If you are scuba diving directly under the same region of the slick than which color (s) the film will appears to you.
6. A Newton's ring apparatus is to be used to determine the radius of curvature of a lens. The radii of the n^{th} and $(n + 20)^{\text{th}}$ bright rings are found to be 0.162 and 0.368 cm, respectively, in light of wavelength of 420 nm. Calculate the radius of the curvature of the plano-convex lens Ans. 1.30 m
7. Two waves of the same frequency have amplitudes 1.60 and 2.20. They interfere at a point where their phase difference is 60.0° . What is the resultant amplitude? Ans. 3.30
8. The reflection of perpendicularly incident white light by a soap film in air has an interference maxima at 478.8 nm and a minimum at 598.5 nm, with no minima in between. If $n = 1.33$ for the film, what is the film thickness, assumed uniform. Ans. 450 nm

9. If one of the mirror in Michelson's interferometer is moved through 0.233mm keeping other mirror fixed, a shift of 1110 bright fringes occurs. Calculate the wavelength of the light producing the fringe pattern. Ans. 420 nm
10. The rhinestones in costume jewelry are glass with refractive index 1.50. To make them more reflective, they are often coated with a layer of silicon monoxide of refractive index 2.00. What is the minimum coating thickness needed to ensure that light of wavelength 500 nm and of perpendicular incidence will be reflected from two surfaces of the coating with constructive interference? Ans. 62.5 nm
11. The diameter of the tenth dark ring in a Newton's ring experiment, viewed normally by reflected light of $\lambda = 5.9 \times 10^{-5}$ cm is 0.50 cm. Calculate the thickness of the air film and the radius of curvature of the lens. Ans. $t = 2.95 \times 10^{-4}$ cm and $R = 1.06$ cm
12. If the diameter of the n^{th} dark ring in a Newton's ring experiment changes from 0.30 cm to 0.25 cm as a liquid is introduced between the lens and the plate, calculate the velocity of light in the liquid. Ans. 2.08×10^8 m/s.
13. Consider the formation of Newton's ring when two closely spaced wavelengths $\lambda_1 = 5890 \text{ \AA}$ and $\lambda_2 = 5896 \text{ \AA}$ are present. (A).What will be the effect of the presence of these two wavelengths as the lens is gradually moved up from the plate? (B).What will happen if the above source of light is replaced by a white light?
14. The Michelson's interferometer experiment is performed with a source which consists of two wavelength 4882 \AA and 4886 \AA . Through what distance does the mirror have to be moved between two positions of the disappearances of the fringes? Ans. 0.298 mm
15. A glass plate of refractive index 1.50 is to be coated with a film of some transparent material of refractive index 1.25. What would be the minimum thickness of the film so that light of wavelength 6000 \AA incident normally is not reflected? Ans. 1200 \AA
16. An oil film of refractive index of 1.33 is illuminated by a parallel beam of light of wavelength 5890 \AA at an angle of 45° . Find the minimum thickness of the film for which the film will appear completely dark? Ans. 2.614×10^{-7} m.
17. The inclined faces of a biprism ($\mu = 1.5$) make angle of 1° with the base of the prism. The slit is 10 cm from the biprism and is illuminated by the wavelength of 590 nm. Find the fringe width observed at a distance from biprism. Ans. 3.72×10^{-4} m.
18. Discuss the working principle and construction of the Fabry-Perot interferometer.