Assignment: 01 (Engineering Physics-TPH 101) I sem 2022

Theoretical/Numerical on Interference

Q.1 Explain the condition of sustained interference and need of coherent source (Justify the need of Coherent sources). What is the difference in interference patterns obtained in Fresnel's Biprism and Newton's Ring experiment. Give examples of interference in thin transparent films.

Q.2 Discuss the determination of wavelength using Fresnel's Biprism experiment. Explaining the method of Deviation and Displacement of 2d.

Q.3 Derive the condition of interference in ihin wedge shape film.

Q.3 Discuss the interference in Newton's ring experiment. Also derive the expressions of bright and dark rings.

Q.4 Two coherent sources whose intensity ratio is 100:1 produce interference fringes. Deduce the ratio of maximum intensity to minimum intensity in fringe system.

[Hint: $I_{max} / I_{min} = (a+1)^2/(a-1)^2$. I **α** $(amplitude)^2$].

Q.5 In a Fresnel biprism experiment (λ=6000 A^0), the micrometer readings for zero order and 12^{th} order fringe are 1.25 mm and 2.50 mm respectively.

(a) What will be the position of zero order and 10^{th} fringe when λ is changed to 6500A^0.

Q.6 In the Fresnel biprism experiment the angle of the glass (α) is 2^0 and μ = 1.5. Interference fringes are formed with a source of wavelength (λ) 6000A^0 located at 10 cm from the prism and source–screen distance is 100 cm. Find the maximum number of fringes (**n**) that can be observed.

(Hint $n\omega = n D\lambda/$**2d** and from deviation method **2d** = 2a (μ-1) α. Since distance is given in cm therefore convert the rest of the parameters in **cm** and **angle in radian [radian = angle (deg.) x π/180**]. 2d is the distance in which the fringes can be observed if the rays from margin of prism travel parallel to horizontal line).

Q.7 Biprism fringes are produced using a source of wavelength 5893A^0. The μ = 1.50 and refracting angles (α_1) 1.04^0 and (α_2) 1.23^0. The distance of the focal plane of the eyepiece from the biprism is 56.1 cm and the distance from slit to biprism is 13.8cm. Find 2d and fringe width (ω).

(Hint: The prism angles are not same therefore find $\alpha = \alpha_1 + \alpha_2$ then convert it into radian. Convert the 5893A^0 into cm.)

Q.8 In Newton's ring the diameter of 15^{th} ring is 0.009m. Find radius of curvature of lens and thickness of the air film. ($\lambda = 6 \times 10^{-7}$ m)

[Hint: In Newton's ring, when wedge shaped film is filled with medium of refractive index μ, the dia. of any n^{th} dark ring is given by $D_n^{2}{}_{(liquid)} = \frac{4n\lambda R}{\mu}$ (for air wedge film μ = 1). Then find thickness (t) by $2t = D_n^2/4R$]

Q.9 In Newton's ring experiment, the diameter of any 10^{th} bright ring is 1.90 cm. Given radius of curvature of lens = 200 cm then find the wavelength (λ) of the source.

[Hint: $D_n^{2}{}_{(bright)} = 2\,(2n+1)\,\lambda\,R$]

Q.10 In Newton's ring experiment, given the diameters of 6^{th} dark ring =0.300cm, 10^{th} dark ring = 0.600cm and 13^{th} dark ring = 0.900cm. Find the diameter of 17^{th} dark ring.

[Hint: Using relation $(D_{n+p}^2 - D_n^2)_{(air)} = 4p\lambda R$, we can write $(D_{10}^2 - D_6^2) = 4 \times 4x\,\lambda R$ (here n+p = 10 and n=6 therefore p = 4) and $(D_{17}^2 - D_{13}^2) = 4 \times 4 \times \lambda R$ (here n+p = 17 and n=13 therefore p = 4). Dividing these two relations we can find D_{17}.]