# ABES Engineering College Ghaziabad

**Department of Applied Sciences & Humanities**

**Tutorial Sheet – Unit-3 (2023-24)**

**Sub. Name: Engineering Physics** **Sub. Code: BAS101**

**Date of Issue:** **Date of Submission:**

## INTERFERENCE

1. Light of wavelength 5893 Å is reflected at nearly normal incidence from a soap film of μ = 1.42. What is the least thickness of the film that will appear (i) dark (ii) bright? (**Ans: t=2075 Å, t=1037.5 Å) (2003,2004,2005)**
2. White light is incident on a soap film at an angle of $\sin^{-1}$ (4/5), the reflected light on examination by a spectroscope shows dark bands. Two consecutive dark bands correspond to wavelengths $6.1x10^{-5}$cm & $6.0x10^{-5}$ cm. If μ=4/3 for the film, calculate its thickness? [**Ans:0.0017 cm**] **(2007)(I sem-2022)**
3. A soap film of refractive index 1.43 is illuminated by white light incident at an angle of $30^0$.The reflected light is examined by a spectroscope in which dark band corresponding to the wavelength $6x10^{-7}$m is observed. Calculate the thickness of the film. [**Ans:2.28x $10^{-5}$ cm**] **(2002)**
4. White light is incident normally on a thin film of thickness 0.50x $10^{-6}$m and index of refraction 1.50. Find the wavelength in visible region (400nm – 700nm) reflected most strongly. [**Ans:428.6nm,600nm**] ] **(2009)**
5. Two plane glass surfaces in contact along one edge are separated at the opposite edge by a thin wire. If 20 interference fringes are observed between these edges in sodium light of normal incidence, what is the thickness of the wire? [**Ans:5.89 X $10^{-4}$cm**](**2013**,**2011,2004**)
6. Light of wavelength 6000Å falls normally on a thin wedge shaped film of refractive index 1.4 forming fringes that are 2.0mm apart. Find the angle of wedge in seconds.
   **[ Ans:21.96sec] (2010,2005,2018)**
7. A square piece of cellophane film with index of refraction1.5 has a wedge shaped section so that its thickness at two opposite sides is $t_1$ and $t_2$. If the number of fringes appearing with wavelength λ = 6000Å is 10, calculate the difference ($t_1 - t_2$). [ **Ans:2x$10^{-4}$ cm]** (**2008**)
8. In Newton's ring experiment the diameter of $4^{th}$ and $12^{th}$ dark rings are 0.400 cm and 0.700 cm respectively. Deduce the diameter of $20^{th}_{dark}$ ring. [ **Ans:0.906 cm]** (**2007**)
9. Newton's rings are observed normally in reflected light of wavelength 6000Å. The diameter of the $10^{th}$ dark ring is 0.50cm. Find the radius of curvature of the lens and the thickness of the film. [ **Ans:3x$10^{-4}$ cm]** (**2002,2005, odd sem 2022-23**)
10. Calculate the thickness of a soap buble thin film that will result in constructive interference in reflected system. The film is illuminated with light of wavelength 5000Å and refractive index of the film is 1.45.**(2021)**

## DIFFRACTION

11. A light of wavelength 6000Å falls normally on a strength slit of width 0.10mm. Calculate the total angular width of the central maximum and also the linear width as observed on a screen placed 1m away.[ **Ans:1.2x $10^{-2}$rad, 1.2x $10^{-2}$ cm]** (**2009,2010,2017, even sem 2022-23**)
12. Light of wavelength 5500Åfalls normally on a slit of width 22.0X $10^{-5}$ cm. Calculate the angular position of the first two minima either side of the central maximum. [**Ans:$\theta_1$= $14^0 29'$,$\theta_2$= $30^0$]** (**2003**)

13. Calculate the angle at which the first dark band and the next bright band are formed in the Fraunhofer diffraction pattern of a slit 0.3mm wide **[Ans:$\theta_1 = 0.112^0, \theta_2 = 0.168^0$](2007,2008)**
14. Calculate the angle between the central image of a lamp filament and its first diffracted image produced by a fabric with 160 threads per cm ($\lambda = 6x10^{-5}$cm). [**Ans: $\theta$ = 33min] (2010)**
15. Find the angular separation of 5048Å and 5016Å wavelength in second order spectrum obtained by a plane diffraction grating having 15000 lines per inch. [**Ans: $d\theta = 3.787 \times 10^{-4}$ radian](2013, 2018 even).**
16. A diffraction grating used at normal incidence gives a yellow line ($\lambda$= 6000 A°) in a certain spectral order superimposed on a blue line ($\lambda$= 4800 A°) of next higher order. If the angle of diffraction is $Sin^{-1}$ (3/4), obtain the grating element**. (Ans. $3.2 \times 10^{-4}$ cm) (2004).**
17. A diffraction grating used at normal incidence gives a green line (5400 Å) in a certain order n superimposed on the violet line (4050 Å) of the next higher order. If the angle of diffraction is $30^0$, calculate the value of n. Also find how many lines per cm are there in the grating? **[Ans.3086] (2005,2008).**
18. How many orders will be observed by a grating having 4000 lines per cm, if it is illuminated by light of wavelength in the range 5000 Å to 7500 Å. **[Ans.3 to 5 orders] (2004).**
19. Can $D_1$ and $D_2$ lines of Na (sodium) light be resolved (for $\lambda_{D1}$ = 5890Å, $\lambda_{D2}$ = 5896Å) in second order. Number of lines in grating of 2.0 cm wide =4500?**(Ans. N=491, lines can be resolved) (2006).**
20. Adiffraction grating is just able to resolve two lines of wavelengths 5140.34 Å and 5140.85Å in the first order. Will it resolve the lines 8037.20Åand 8037.50 Å in the second order? **(Ans. lines can not be resolved) (2006).**

23. Find the minimum number of lines in a plane diffraction grating required to just resolve the sodium doublet (5890Å and 5896 Å) in the (i) first order (ii) second order.? **(Ans N=982, 491) (2000,2005,2008).**

**24.** A plane transmission grating has 15000 lines per inch. Find the resolving power of grating and the smallest wavelength difference that can be resolved with a light of wavelength 6000Å in the second order. **(Ans. $d\lambda$=0.2 Å) (2016, even sem 2022-23)**

25. Two spectral lines have wavelength $\lambda$ & $\lambda + d\lambda$ respectively. Show that if $d\lambda << \lambda$, then the angular separation $d\theta$ in the grating spectrum is given by

$$d\theta = \frac{d\lambda}{\sqrt{\left(\frac{e+d}{n}\right)^2 - \lambda^2}}$$ (**2011,2012**)

26. In a grating spectrum, which spectral line in $4^{th}$ order will overlap with $3^{rd}$ order line of 5416Å**. (2019)**