Engineering Physics (BAS101)
List of Important Questions

UNIT-3 : Wave Optics

|| Short Answer Type Questions ||

1. What are coherent sources of light ?
2. Explain why two independent sources of light can never be coherent?
3. Why extended source of light is required in interference?
4. Why Newton's rings are circular in shape ?
5. Why central spot of Newton's rings appears dark in reflected light ?
6. Explain the missing order spectra in plane transmission grating?
7. Define dispersive power of a plane transmission grating?
8. Explain Rayleigh's criterion of just resolution ?

|| Long Answer Type Questions ||

1. Discuss the phenomena of interference of light due to thin films of uniform thickness in reflected light and find the conditions of maxima and minima hence prove that the conditions of maxima and minima in reflected and transmitted light are complementary to each other.
2. Discuss the formation of interference fringes due to wedge shaped thin film seen by normally reflected Sodium light and hence obtain an expression for fringe width.
3. Describe and explain the formation Newton's rings. Prove that in reflected light, diameters of dark rings are proportional to the square root of natural numbers while diameters of bright rings are square root of odd natural numbers.
4. Describe Newton's ring method for measuring wavelength of monochromatic light and refractive index of a liquid.
5. Discuss the phenomenon of Fraunhoffer diffraction at a single slit and show that the relative intensity of the successive maximum are nearly $1 : (4/9\pi^2) : (4/25\pi^2) : 4/49\pi^2$ or and so on.
6. Give the theory of a plane transmission grating and show how would you use it to determine the wavelength of light.
7. What do you mean by mission order or absent spectra? What particular spectra would be absent if the width of transparency and opacity of the grating are equal?
8. Define resolving power of grating and hence obtain an expression for resolving power of a plane transmission diffraction grating.

|| Numerical Problems ||

1. Light of wavelength 5893 Å is reflected at nearly normal incidence from a soap film of refractive index 1.42. What is the least thickness of the film that will appear i) dark ii) bright?
2. A soap film of refractive index 1.43 is illuminated by white light incident at an angle of 30°. The refracted light is examined by a spectroscope in which dark band corresponding to wavelength 6×10^{-7} m is observed. Calculate the thickness of the film.
3. White light is incident on a soap film at an angle $\sin^{-1}(4/5)$. In reflected light, two dark consecutives bands are observed corresponding to wavelengths 6.1×10^{-5} and 6.0×10^{-5} cm. If the refractive index of

film be 4/3, calculate its thickness.

4. A soap film of refractive index 1.33 is illuminated with light of different wavelength at an angle 45°. There is complete destructive interference for wavelength λ=5890 Å. Find the thickness of the film.

5. A parallel beam of light of sodium light strikes a film of oil (μ=1.46) floating on water(μ=1.33). When viewed at an angle of 30° from the normal, the eighth dark band is seen. Find the thickness of film.

6. Light of wavelength 6000 Å falls normally on a thin wedge-shaped film of refractive index1.4, forming fringes that are 2.0 mm apart. Find angle of wedge in seconds.

7. Two plane glass surfaces in contact along one edge are separated at the opposite edge by a thin wire. If 20 fringes are observed between these edges in sodium light of wavelength 5890 Å for normal incidence, find diameter of the wire.

8. Newton's rings are formed in reflected light of wavelength 6000 Å with a liquid between the plane and curved surfaces. If the diameter of the sixth bright ring is 3.1 mm and the radius of curvature of the curved surface is 100 cm. find the refractive index of liquid.

9. Newton's rings are observed normally in reflected light of wavelength 6000 Å. The diameter of 10^{th} dark ring is 0.50 cm. Find the radius of curvature of the lens and the thickness of the film.

10. Newton's rings are observed by keeping a spherical surface of 100 cm radius on a plane glass plate. If the diameter of 15^{th} bright ring is 0.590 cm and the diameter of 5^{th} dark ring is 0.336 cm. What is the wavelength of incident light used?

11. In Newton's ring experiment, the diameter of 4^{th} and 12^{th} dark rings are 0.4 cm and 0.7 cm respectively. Deduce the diameter of 20^{th} dark ring

12. Newton's ring experiment, the diameter s of the 4^{th} and 12^{th} dark rings are 0.40cm and 0.70 cm respectively. Find the diameter of 20^{th} dark ring.

13. The diameter of 5^{th} dark ring in Newton's ring experiment was found to be 0.42 cm. Determine the diameter of the 10^{th} dark ring.

14. In Newton's ring experiment it was found that the n^{th} dark ring due to wavelength $\lambda_1=6.0\times10^{-5}$ cm (or 6000 Å) coincides with $(n+1)^{th}$ dark ring due to wavelength $\lambda_2=5.0\times10^{-5}$ cm (or 5000 Å). If the radius of curvature of the Plano convex lens used is 2 m, find the diameter due to n^{th} dark ring of wavelength $\lambda_2=5.0\times10^{-5}$ cm (or 5000 Å).

15. The diameter of bright ring in Newton's rings experiment was observed to decrease from 2.3 cm to 2.0 cm when air is replaced by liquid in the gap between curved surface of plano convex lens and plane glass plate. Determine the refractive index of liquid.

16. A single slit is illuminated by light composed of two wavelengths λ_1 and λ_2. One observes that due to Fraunhoffer diffraction, the first minima obtained for λ_1 coincides with second diffraction maxima of λ_2. What is the relation between λ_1 and λ_2.

17. A light of wavelength 6000 Å falls normally on a straight slit of width 0.10 mm. Calculate the angular width of the central maximum and also the linear width as observed on a screen placed 1 meter away.

18. A plane beam of monochromatic light is allowed to be incident normally on a plane diffraction grating having 5000 lines per cm. The second order spectral line is observed to be deviated through 30°. Calculate the wavelength of the spectral line.

19. In a plane transmission grating, the angle of diffraction for second order principal maximum for the wavelength 5000 Å is 30°. Calculate the number of lines in one centimeter of the grating.

20. A diffraction grating used at normal incidence gives a yellow line (λ=6000 Å) in a certain spectral order is superimposed on a blue line (λ=4800 Å) of next higher order. If the angle of diffraction is $\sin^{-1}(3/4)$, calculate the grating element.

21. How many orders will be visible if the wavelength of incident light is 5000 Å and the number of lines per inch on the grating is 2620.

22. Calculate the least width of a plane diffraction grating having 500 lines/cm which will just resolve in second order the sodium lines of wavelength of 5890 Å and 5896 Å.

23. A plane transmission grating has 15000 lines per inch. Find the resolving power of grating and the smallest wavelength difference that be resolved with a light of wavelength 6000 Å in second order.

24. Find out if a grating will resolve the lines 8037.20 Å and 8037.50 Å in the second order given that the grating is just able to resolve two lines of wavelength 5140.34 Å and 5140.85 Å in first order.