Haldia Institute of Technology
Department of Applied Science

Assignment - II

Course: PH 101/PH 201
Module2: *Optics1*

1) Define Huygens' theory of wave front construction.
2) What is monochromatic light wave? What do you mean by coherent source?
3) What do you mean by ghost lines and absent spectra?

4) What is interference of light? Write down the conditions of sustained interference. What is spatial and temporal coherence? If the amplitudes of two coherent light waves are in the ratio 1:4, find the ratio of maximum and minimum intensity in the interference pattern.

5) In Young's double slit experiment the slits are 0.2 mm apart and the screen is 1.5 m away. It is observed that the distance between the central bright fringe and the fourth dark fringe is 1.8 cm. Find the wavelength of light.

6) In Young's experiment the width of the fringe obtained with light of wavelength 6000Å is 2 mm. What will be the fringe width if the entire apparatus is immersed in a liquid of refractive index 1.33?

7) Newton's ring experiment is performed with reflected light of wavelength 5700 Å using a plano-convex lens and a plane glass plate. What would be the observation when the glass plate is moved away from the lens along the axis of the lens by 10^{-5} m?

8) (i) Why is the centre of Newton's ring dark?

(ii) In Young's double slit experiment, fringes appear as straight line. Explain.

(iii) How does interference pattern by reflection in thin film differ from that of refraction (transmission)?

9) The intensity distribution for a single slit diffraction is

$$I = I_0\left(\frac{\sin^2\beta}{\beta^2}\right) \text{where } \beta = \frac{\pi b \sin\theta}{\lambda}$$

b is the width of the slit and λ is the wavelength of light. Show that the secondary maxima are given by the equations tanβ=β.

10) What is the effect of (a) increasing the slit width (b) increasing the slit separation and (c) increasing the wavelength of light in a double slit diffraction pattern.

11) A single slit forms a diffraction pattern of Fraunhofer class with white light. The second maximum in the pattern for red light of wavelength 7000 Å coincides with the third maximum of an unknown wavelength. Calculate the unknown wavelength.

12) What is a Grating? Show that the resolving power of a grating is defined by R = mN, where m is the order of the fringe and N is the number of lines in the grating. What is Rayleigh's Criterion?

13) An oil immersion microscope just resolves the rulings of a grating having 3900 lines/mm when light of wavelength 400 nm is employed. Find the numerical aperture of the lens.

14) A parallel beam of light of wavelength 500 nm is incident normally on a narrow single slit of width 0.2 mm for a Fraunhofer diffraction pattern. Find the angular position of the first and the second maxima.

15) A parallel beam of light is incident on a narrow slit of width 0.2 mm. A Fraunhofer diffraction pattern observed at the focal plane of a convex lens of focal length 20 cm. Calculate the distance between the first two minima and maxima. Given, $\lambda = 5x10^{-5}$ cm.

16) Consider a diffraction pattern by a grating with 15000 lines per inch, Show that if we use a white light source, the second and third order spectra overlap. Given, the wavelength of violet and red light is $4x10^{-5}$ cm. and $7x10^{-5}$ cm.