DIFFRACTION H.W.

* Path difference $= d \sin\theta$ Where, d = slit width

* Path difference $= \frac{xd}{D}$

* Condition for diffraction minima $\rightarrow \sin\theta n = \frac{n\lambda}{d}$; $n = 1, 2, 3, ...$

* Condition for diffraction maxima $d \sin\theta = (2n + 1)\frac{\lambda}{2}$; $n = 1, 2, 3,....$

* Width of secondary maxima or secondary minima is given by $\beta = \frac{D\lambda}{d}$

* Width of central maxima $= 2\beta$

  Width of central maxima $= 2\left(\frac{D\lambda}{d}\right)$

* Resolving power of microscope $= \frac{2\mu \sin\theta}{\lambda}$

  Where, $(\mu \sin\theta)$ = Numerical Aperture

* Limit of resolution $= \frac{1}{\text{Resolving Power}}$

  Resolving power of Telescope $= \frac{D}{1.22\lambda}$

  Where, D = diameter of objective of telescope

* Limit of angular reperation $= \frac{1.22\lambda}{D}$

1. Diffraction pattern of single slit of width 0.5cm is formed by lens of focal length40cm. Calculate th distance between the first dark and the next bright fringe from the axis. Wavelength of light used is $4890A^0$. (ANS: 1.956×10^{-2} mm)

2. Monochromatic light of wavelength 4300 A.U. falls on slit of width 'a' For what value of 'a' if the first maximum falls at 30^0? (ANS:12900A.U.)

3. Sodium light of wavelength 5893 A^0 falls normally on a slits of width 0.05 mm. Calculate angular position of first two diffraction minima. (ANS: $\theta_1 = 0^0 40'$, $\theta_2 = 1^0 21'$)

4. In a single slit diffraction pattern, the distance between the first minimum on the right and the first minimum on the left is 5.2 mm. The screen on which the pattern is displayed is 80 cm from the slit and the wavelength is 5460 A^0. Calculate the slit width. (ANS: d = 0.168 mm)

Formulae : Limit of resolution $d = \frac{\lambda}{2\mu \sin\theta}$

5. What is the minimum angular seperation between to stars if telescope is used to observe them with an objective of aperture 20 cm? The wavelength of light used is 5900 AU. Calculate R.P. (ANS: $\text{min angular} = 3.6 \times 10^{-6}$ rad seperation, $\text{R.P.} = 2.793 \times 10^5$)

6. The semivestical angle of cone of the rays incident on the objective of microscope is 20^0. If the wavelength of incient light ray 6600A^0, Calculate the smallest distance between two points which can be just resolved. (ANS: $d = 11770 A^0$)

7. Sodium light of wavelength 5890 A^0 is used to view an object under a microscope. The numerical aperture of the objective is 0.12. Find the limit of resolution and resolving power of microscope. (ANS: $d = 2.454 \times 10^{-6}$ m, R.P. $= 4.075 \times 10^5$ per meter)