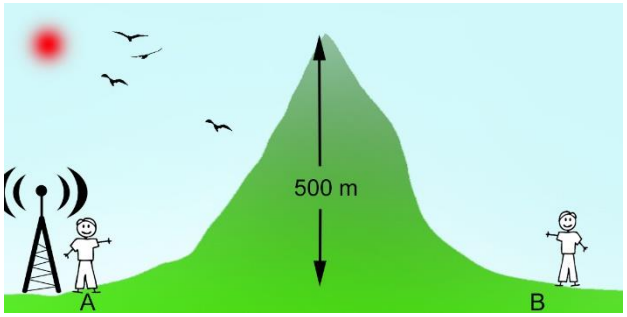
Tutorial Sheet-3

15B11PH111 Physics-1 (2020-2021)

(Lecture 7-10)

Assignment 3: Find the intensity relation for case of N-slit diffraction using superposition principle

1. In the figure, if person A wants to communicate with person B, then which of following method he can choose for communication and why?
   (a) Cellphone
   (b) Radio Waves
   (c) Visible Light



CO1

2. A narrow single slit in an opaque screen is illuminated by infrared from a He-Ne laser at 1152.2 nm in air, and it is found that the center of the tenth dark band in the Fraunhofer pattern lies at an angle of 6.2° off the central axis. Determine the width of the slit. At what angle will the tenth minimum appear if the entire arrangement is immersed in water (n_w = 1.33) rather than air? CO3
3. Suppose that in Young's experiment, slits of width 0.020 mm are separated by 0.20 mm. If the slits are illuminated by monochromatic light of wavelength 500 nm, how many bright fringes are observed in the central peak of the diffraction pattern? CO3
4. In a double slit Fraunhofer diffraction pattern, the screen is placed 160 cm way from the slits. The width of the slits is 0.08 mm and the width of opaque part between the slits is 0.32mm. Calculate the angular position of first maxima and first diffraction minima if the wavelength of light used is 400nm. Calculate the missing orders also. CO2
5. What are the advantages of a diffraction grating over a prism in dispersing light for spectral analysis? CO2

6. Coherent light with a wavelength of λ = 500 nm is sent through two parallel slits, each having a width b=0.700 µm. The distance between the centers of the slits is d= 2.80 µm. The screen has a semi-cylindrical shape, with its axis at the midline between the slits.
   (a) Find the direction of the interference maxima on the screen. Express your answers in terms of the angle away from the bisector of the line joining the slits.
   (b) How many bright fringes appear on the screen?
   (c) For each bright fringe, find the intensity, measured relative to the intensity I0 associated with the central maximum. CO3

7. A plane transmission grating having 15,000 lines per inch is used to obtain a spectrum of light from a sodium lamp in the second order. Calculate (a) the angular separation between D1 and D2 lines of sodium, and (b) order at which overlapping occurs. Is this overlapping order visible? [wavelengths of D1 and D2 lines of sodium are 5890 Å and 5896 Å respectively] CO3