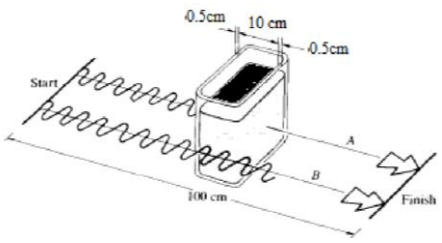
Tutorial Sheet 1

15B11PH111 Physics-1 (2020-2021)

Assignment 1: Study Young's double slit experiment and obtain the expression of fringe width

1. Determine the optical path difference for the two waves A and B, both having vacuum wavelengths of 500 nm. As depicted in figure, the glass (n= 1.52) tank is filled with water (n = 1.33). If the waves start out in-phase and all the above numbers are exact. Find their relative phase difference at the finishing line. Ans. 3.82 cm, multiple of 2π [CO3]



2. Two waves travelling in the same direction are given by $y_1 = 1.0\sin\omega t$ and $y_2 = 2.0\sin\left(\omega t + \frac{\pi}{3}\right)$.

   Find (a) the resultant amplitude, (b) initial phase angle of the resultant wave, and (c) the resultant equation of motion. Ans.: (a) 2.7, (b) 40.89°, and (c) $Y = 2.7\sin\left(\omega t + 0.227\pi\right)$ [CO2]
3. In the YDSE, interference fringes are formed using sodium light which predominantly comprises of two wavelengths (5890Å and 5896Å). Obtain the regions on the screen where the fringe pattern will disappear. Assume,d=0.5 mm and D=100 cm. Ans. 57.8 cm from the central fringe. [CO3]
4. Fringes are formed by a Fresnel's bi-prism in the focal plane of a reading microscope, which is 100 cm from the slit. A lens inserted between the biprism and the microscope gives two images of the slit in two positions. In one case the two images of the slit are 4.050 mm and in other, they are 2.900 mm apart. If the sodium light (λ=589.3 nm) is used, find the distance between the interference fringes. Ans.: 0.172 mm [CO2]
5. The inclined faces of a bi-prism of refractive index 1.5 make an angle of 2°with the base. A slitilluminated by monochromatic light is placed at a distance of 10 cm from the bi-prism. If the distance between two dark fringes observed at a distance of 1.00 m from the prism is 0.18 mm, findthe wavelength of light used. Ans. 571.2 nm [CO2]
6. With the help of Stokes's relations, estimate the amplitude of the first three reflected and first three transmitted beams from a parallel, non-absorbing glass (n=1.52) plate, if the incident beam is falling normally and of unit amplitude. Ans.: Reflected (0.206, 0.197, 0.0084);Transmitted (0.957, 0.041, 0.0017) [CO3]
7. Give example of interference experiment where (i) both coherent sources are real (ii) one source is real and one is virtual (iii) both coherent sources are virtual. [CO1]
8. How one can locate central fringe in Fresnel's bi-prism experiment? [CO1]