Habib University
Dhanani School of Science and Engineering

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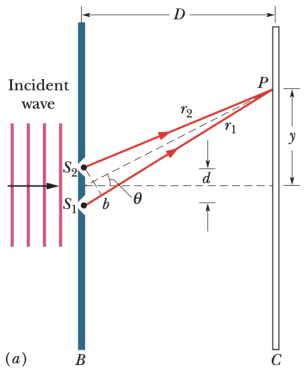
Integrated Sciences and Mathematics (iSciM)

Quantum Mechanics Spring 2023
Exercise Sheet 1
Issued : 17 January 2022 **Due : 24 January 2023**

Note : *Please submit your scanned solutions directly on canvas before the deadline. Answers will be uploaded soon after the deadline.*

Problem 1 (10 marks)

What is the distance on screen C in Fig between adjacent maxima near the center of the interference pattern ? The wavelength l of the light is 546 nm, the slit separation d is 0.12 mm, and the slit – screen separation D is 55 cm. Assume that u in Fig is small enough to permit use of the approximations $\sin\theta \approx \tan\theta \approx \theta$, in which θ is expressed in radian measure.



Problem 2 (5 marks)

A double-slit arrangement produces interference fringes for sodium light ($\lambda = 589nm$) that have an angular separation of 3.50×10^{-3} rad. For what wavelength would the angular separation be 10.0% greater ?

Problem 3 (10 marks)

Suppose a monochromatic coherent source of light passes through three parallel slits, each separated by a distance d from its neighbor, as shown in the Figure. The waves have the same amplitude E_0 and angular frequency ω , but a constant phase difference $\phi = 2\pi d \sin\theta/\lambda$. (a) Show that the intensity is

$$I = \frac{I_0}{9}\left[1 + 2\cos\left(\frac{2\pi d \sin(\theta)}{\lambda}\right)\right]^2 \qquad (1)$$

where I_0 is the maximum intensity associated with the primary maxima. (b) What is the ratio of the intensities of the primary and secondary maxima ?