# Oscillations, Wave and Optics

(SPRING 2025)

## ASSIGNMENT-7

Topics: Wave Optics | Total Marks: 40

Date: 26th Apr, 2025 | **Due: 3rd May, 2025** (EoD) No extension!

## Problem [40]

**(1)** A double-slit of slit separation $0.5\text{mm}$ is illuminated at normal incidence by a parallel beam from a helium-neon laser that emits monochromatic light of wavelength $632.8\,\text{nm}$. A projection screen is located $5\,\text{m}$ behind the slit. What is the separation of the central interference fringes on the screen? **(5)**

**(2)** Consider a double-slit interference/diffraction experiment in which the slit spacing is $d$, and the slit width $\delta$. Show that the intensity of the far-field interference pattern, assuming normal incidence by monochromatic light of wavelength $\lambda$, is

$$\mathcal{I}(\theta) \propto \cos^2\left(\pi \frac{d}{\lambda} \sin\theta\right) \text{sinc}^2\left(\pi \frac{\delta}{\lambda} \sin\theta\right)$$

Plot the intensity pattern for $d/\lambda = 8$ and $\delta/\lambda = 2$. **(10+5)**

**(3)** Discuss the multi-slit diffraction phenomenon in detail with diagram. **(15)**

**(4)** What is the theoretical maximum angular resolving power (in arc seconds) of a conventional reflecting telescope with a 12 in main mirror? **(5)**