Time: 01 hour.

Answer **ALL** Questions

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1) When two monochromatic light beams of wavelength λ, intensities I_1 and I_2 and phase difference δ are interfered at any point in space as shown in figure 1, **obtain** an expression for the resultant intensity distribution I_P at point P. Hence, **obtain** the conditions for maximum and minimum intensities and **show** a schematic plot describing the variation of I_P against δ.
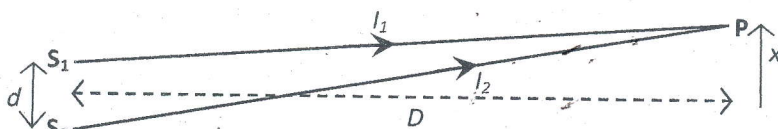
... (45% marks)

Figure 1

Illustrate by a schematic ray diagram the Lloyd's Mirror experimental arrangement, and **show** that the phase difference is given by $y = \frac{2\pi}{\lambda}\left(\frac{xd}{D}\right) + \pi$; where symbols refer to Figure 1.

... (20% marks)

In a Lloyd's mirror experiment, a source of 580 nm wavelength is placed in front of a screen in 200 cm to obtain the interference fringes. **Calculate** the distance between the source and its image (virtual source), if the 5th order dark fringe is measured to be 5 cm above the horizontal axis through the mirror.

... (35% marks)

2) If a thin transparent wedge film of refractive index μ is placed in a medium having refractive index μ_1, then the phase difference between the two beams reflected from the two surfaces of the film is given by $\delta = \frac{2\pi}{\lambda} 2d \cos\theta \pm \pi$, where "+" is when $\mu < \mu_1$ and "–" is when $\mu > \mu_1$, and θ is the angle of the incident beam. When the two reflected beams interfere, bright fringes are formed when $\delta = 2m\pi$, where m is an integer.

(a) **Distinguish** "fringes of equal thickness" from "fringes of equal inclination", describing localized and non-localized fringes.

... (25% marks)

(b) Fringes of equal thickness are formed due to an air wedge in glass medium. If the fringe width is measured to be 1.2 mm for monochromatic light of wavelength 5890 Å, then **calculate** the inclination of the wedge film.

... (35% marks)

(c) Fringes of equal inclination are formed with a plane parallel glass plate of refractive index 1.50 and thickness 2 mm kept in air medium. If a monochromatic light source of wavelength 6000 Å is used, then **find** how many bright fringes are formed in the entire range from normal incidence to grazing incidence.

...(40% marks)