Problem Sheet-1

1. Based on the knowledge gain while studying interference phenomena, write conditions for sustainable interference pattern. [CO1]
2. Two coherent sources of Intensity ratio α interfere. Prove that $\frac{I_{max}-I_{min}}{I_{max}+I_{min}}=\frac{2\sqrt{\alpha}}{1+\alpha}$ [CO2]
3. How can we identify the zeroth order fringe in YDSE or Fresnel's bi- prism experiment? [CO2]
4. In Fresnel's bi-prism, show that if $D > 4f$ one will obtain two positions of the lens where the image of the slits will be formed at the eyepiece; here f is the focal length of the convex lens and D is the distance between the slit and the eyepiece. What would happen if $D = 4f$ or $D < 4f$? [CO4]
5. A soap film of refractive index μ is illuminated with white light incident at an angle i. The light refracted by it is examined and two bright bands focused corresponding to wave lengths $\lambda_1$and λ_2. Show that the thickness of the film is given by $t=\frac{\lambda_1\lambda_2}{\lambda_1-\lambda_2}\left[\frac{1}{2\sqrt{\mu^2-\sin^2 i}}\right]$ [CO3]
6. Interference fringes are produced by monochromatic light incident normally on a wedge shaped film of cellophane (μ = 1.40). If the angle of the wedge is 20 seconds of an arc and the distance between successive fringes is 0.25 cm, calculate the wavelength of light used. Ans.:679 nm [CO2]
7. In the Newton's ring experiment the incident light consists of two wavelength 400.0 nm and 400.2 nm, if the lens is moved upward, calculate the height of the lens at which the fringes will disappear. Also calculate the distance (from the point of contact) at which the rings will disappear. Assume that the radius of curvature of the curved surface of lens is 400 cm. Ans.: 0.2 mm, 4 cm [CO4]
8. The Michelson interferometer experiment is performed with a nearly monochromatic light source of wavelength 589.0 nm and 589.6 nm. Through what distance does the mirror be moved between positions of disappearance to appearance of the fringes? Ans.: 0.145 mm [CO4]