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Thin Film Interference

A) Theory Questions

1. What is interference of light? State the conditions for sustained or steady interference?
2. Explain interference by division of amplitude.
3. What do you mean by thin film? What should be the approximate thickness of thin film in terms of wavelength of incident light?
4. With the help of mathematical calculations show that when a monochromatic light is incident on the thin film, only first two rays satisfy the condition of interference.
5. With the help of relevant necessary diagram derive an expression for effective optical path difference and hence obtain interference conditions for light reflected from thin film of uniform thickness.
6. Derive interference conditions for light transmitted through thin film of uniform thickness.
7. Why colours which are present in the reflected light are absent in the transmitted light in case of interference in thin film.
8. Explain formation of colours in thin film.
9. What is Anti-reflection coating? What is another name of Anti-reflection coating coatings?
10. Derive expressions for thickness and refractive index of film deposited on the surface of glass which act as anti-reflection coating.

B) Numerical Problems

1. A parallel beam of light of wavelength 5890 Å is incident on a plain transparent film of refractive index 1.5. If the angle of refraction is 280. Find the minimum thickness of the film if it appears bright in the reflected light.
2. A soap film of Refractive index 1.34 is illuminated with light of different wavelengths at an angle of 450. Calculate the smallest thickness of the film which will appear dark by reflection. Wavelength of light used is 5890Å.
3. White light falls normally on the soap film (μ=1.33) of thickness 3800 Å. Which wavelength/s within the visible spectrum (4000 Å to 7000 Å) will be intensified in the reflected light?
4. A parallel beam of light falls normally on an oil film of RI 1.25. Complete destructive interference is observed for wavelengths 5000 Å and 6000 Å and for no wavelength in between. Find the thickness of the oil.
5. A soap film of refractive index 1.33 and thickness 1.50μm is illuminated by white light incident at an angle of 450. In the reflected light a dark band is observed for the wavelength 5x10-5 cm. Calculate the order of interference band.
6. A drop of liquid of volume 0.2cc is spread over the whole surface of the tank of water of area 1 sq. m forming a thin film. When white light is incident normally on the film a dark band corresponding to the wavelength 5500 Å is seen in the spectrum. Find the refractive index of the liquid.
7. A parallel beam of sodium light (λ=5890 Å) strikes a film of oil floating on water. When viewed at an angle of 600 from the surface 8th dark band is seen. If the refractive index of the oil is 1.46, find the thickness of the film.
8. White light falls normally on the soap film (μ=1.37) of thickness 3500 Å. Which wavelength/s within the visible spectrum (4000 Å to 7000 Å) will be absent in the transmitted light?
9. Can a thin film of MgF2 of R.I 1.22 act as antireflection film if deposited on glass of R.I 1.52? If yes, determine the minimum thickness required to cutoff reflection due to wavelength of 5500 Å.
10. Calculate the wavelength which would be cut-off from reflection due to a film of thickness 1 micron and refractive index 1.28.