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Thin Film Interference

A) Theory Questions

1. What is interference of light? State conditions of constructive and destructive Interference.
2. State the conditions for sustained or steady interference? Why they are important?
3. Explain interference by division of amplitude.
4. What do you mean by optical path? Why the concept of optical path is important?
5. What do you mean by thin film? What should be the approximate thickness of thin film in terms of wavelength of incident light?
6. 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.
7. Why the interference in reflected light is well defined while in transmitted light it is not so well defined in thin film?
8. Explain combination of media.
9. 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.
10. Derive interference conditions for light transmitted through thin film of uniform thickness.
11. Why colours which are present in the reflected light are absent in the transmitted light in case of interference in thin film.
12. Explain formation of colours in thin film.
13. What is Anti-reflection coating? Why the surface of lens is coated with Anti-reflection coating?
14. What is another name of Anti-reflection coating coatings? State its applications.
15. Using phase conditions derive an expression for thickness of film deposited on the surface of glass as anti-reflection coating.
16. With help of amplitude condition, obtain relation between refractive index of film deposited as anti-reflection coating and the refractive index of glass.

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 28^0. 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 45^0. 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 transmitted 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 45^0. 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 60^0 from the surface 8^{th} 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 MgF_2 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.