SOMAIYA VIDYAVIHAR UNIVERSITY
K J Somaiya College of Engineering

Module 1 Unit 1

THIN FILM INTERFERENCE – NUMERICAL PROBLEMS

1. A parallel beam of light of wavelength 600 nm is incident on a plain transparent film of refractive index $\sqrt{3/2}$. If the angle of incidence is 45°. Find thickness of the film if it appears bright in the reflected light. Assume minimum thickness of film.
2. A soap film of refractive index 1.33 and thickness 1.5 x 10^{-5} cm is illuminated by light incident at 30°. Light reflected from it shows a dark band in the 2nd order. Calculate wavelength corresponding the dark band.
3. A parallel beam of light falls normally on an oil film of refractive index 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.
4. White light falls normally on a soap film (μ = 1.33) of thickness 380 nm. Which wavelength/s within the visible spectrum (4000 – 7000 Å) will be intensified in the reflected light?
5. White light is incident on a soap film of refractive index 1.25 at 50°. Find minimum thickness of the film required if it appears bright yellow (λ = 5893 Å) in the transmitted light.
6. A drop of oil of refractive index 1.20 is spread over a glass plate and it is observed that the thickness of oil drop at the edge is very smallest and gradually increases towards the middle of the oil drop then (i) how will the thinner outer region appear - dark or bright and why? (ii) What will be the thickness of oil layer if reflected light is seen bright green (wavelength = 540 nm) in second order?
7. Calculate the wavelength which would be cut-off from reflection due to a film of thickness 1 micron and refractive index 1.28.
8. Can a thin film of MgF_2 of refractive index 1.22 act as an antireflection film if deposited on glass of refractive index 1.52? If yes, determine the minimum thickness required to cut-off reflection due to wavelength 5500 Å.
9. Determine the thickness of thin coating required for which, it will act as anti-transmitting film for the wavelength of 5000 Å. Given refractive index of the film = 1.28.
10. A binocular has two-layer antireflection coating. The outer coating is MgF_2 (μ = 1.38) and the inner coating is ZrO_2 (μ = 2.10) to reduce reflections due to 6600 Å and 5700 Å respectively. Determine thickness of each coating required.

Homework:

1. An oil drop of volume 2 cc is dropped on the surface of a tank of water of area 1 sq. m. the film spreads uniformly over the surface and white light which is incident normally is observed through a spectrometer. The spectrum is seen to contain one dark band whose centre has wavelength 5.5 x 10^{-6} m in air, find the refractive index of oil.
2. A drop of glycerine of refractive index 1.20 is spread over a glass plate and it is observed that the thickness of oil drop at the edge is very smallest and gradually increases towards the middle of the oil drop then (i) how will the thinner outer region appear - dark or bright and why? (ii) What will be the thickness of oil layer where the wavelength of 540 nm is seen bright in reflected light in second order.
3. A soap film of refractive index 1.33 and thickness 0.11 µm is illuminated by light incident at 30°. The reflected light shows a bright band corresponding to a wavelength of 5 x 10^{-5} cm. Calculate order of interference of the band.

4. A soap film is illuminated by monochromatic light of wavelength 7000 Å incident at certain angle. The film appears bright in reflected light. If its thickness is 1.5 x 10^{-5} cm and refractive index is 1.33, find the angle of incidence for minimum thickness. At what angle would it exhibit destructive interference?
5. White light is incident on a thin film of refractive index 1.4 and thickness 45 micron deposited on a glass plate of refractive index 1.52. The reflected light shows red colour of a wavelength λ at an angle of incidence of 9.8° in a certain order and at 5.74° in the next order. Determine wavelength of the red colour getting reflected.

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