DEPARTMENT OF PHYSICS AND NANOTECHNOLOGY
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

18PYB101J - Electromagnetic Theory, Quantum Mechanics, Waves and Optics

Module-IV (Waves and Optics) Lecture-16

Problem Solving

Problem 1. Calculate the plate thickness of a quarter wave plate for light of wavelength 5.9×10^{-7} m. The refractive index of ordinary and extraordinary ray is 1.544 and 1.553 respectively.

Given data :

Wavelength (λ) = 5.9×10^{-7} m, $\mu_o = 1.544$ $\mu_e = 1.553$

Solution :

Thickness of the QWP $d = \lambda / 4(\mu_e - \mu_o)$

$= 5.9 \times 10^{-7} / 4 (1.553-1.544)$

$= 1.6388 \times 10^{-5}$ m

Problem 2. Calculate the thickness of the half wave plate if the refractive index of ordinary and extraordinary ray is 1.544 and 1.553 respectively. Given: $\lambda = 600$ nm.

Given Data: $\lambda = 6.0 \times 10^{-7}$ m, $\mu_o = 1.544$ $\mu_e = 1.553$

Solution:

Thickness of the HWP $d = \lambda /2 (\mu_e - \mu_o)$

$= 6.0 \times 10^{-7} / 2 (1.553-1.544)$

$= 3.3 \times 10^{-5}$ m

Problem 3: Calculate the thickness of doubly refracting crystal plate required to introduce a path difference of λ/2 between the O and E ray for a light of wavelength 580 nm. The refractive index of ordinary and extraordinary ray is 1.544 and 1.553 respectively.

Given Data: $\lambda = 5.80 \times 10^{-7}$ m, $\mu_o = 1.544$ $\mu_e = 1.553$

Solution:

Thickness of the HWP $d = \lambda/2 (\mu_e - \mu_o)$

$= 5.80 \times 10^{-7} / 2 (1.553-1.544)$

$= 3.22 \times 10^{-5}$ m

Problem 4: Calculate the thickness of a quarter wave plate which would convert plane polarized light into circularly polarized light. Given that $\mu_e = 1.658$, $\mu_o = 1.486$ at the wave length of 5890 Å.

Given Data: $\lambda = 5.890 \times 10^{-7}$ m, $\mu_o = 1.486$ $\mu_e = 1.658$

Solution:

Thickness of the QWP $d = \lambda /4 (\mu_e - \mu_o)$

$= 5.890 \times 10^{-7} / 4 (1.658-1.486)$

$= 8.56 \times 10^{-7}$ m