

Indian Institute of Technology Patna

Department of Physics

PH 201

Mid-semester Examination

Date: Feb. 16, 2015

Time: 2 Hrs.

Full Marks: 30

Answer all questions.

1. Two polaroids are adjusted to obtain maximum intensity. What will be the angle through which one will be rotated to reduce the intensity to half? [1]
2. Calculate the Brewster angle for air-glass interface, $n_1 = 1$ & $n_2 \approx 1.5$. [1]
3. The electric field components of a plane electromagnetic wave are
 $E_x = 2E_0 \cos(\omega t - kz + \phi)$; $E_y = E_0 \sin(\omega t - kz)$
Draw the diagram showing the state of polarization when
(a) $\phi = 0$ (b) $\phi = \pi/2$ (c) $\phi = \pi/4$ [5]
4. A left circularly polarized beam ($\lambda_0 = 589.3$ nm) is incident normally on a calcite crystal (with its optic axis cut parallel to the surface) of thickness 0.005141 mm. What will be the state of polarization of the emergent beam? For calcite, $n_o = 1.65836$ and $n_e = 1.48641$. [5]
5. Explain the principle of multiple beam interferometry and derive the expressions for reflectivity and transmittivity of the Fabry-Perot etalon. [2+3+2]
6. Calculate the resolving power of a Fabry-Perot interferometer made of reflecting surfaces of reflectivity 0.85 and separated by a distance 1.0 mm at wavelength 488 nm. [3]
7. Show that a phase variation of the type
$$\exp\left[ikz + \frac{ik(x^2 + y^2)}{2R(z)}\right]$$
represents a diverging spherical wave of radius R . [4]
8. Discuss the principle of holography. Also, explain how the twin image problem was solved. [4]