

# Indian Institute of Technology Patna

## Department of Physics

### PH 201

### Mid-semester Examination

Date: Feb. 27, 2016

Time: 2 Hrs.

Full Marks: 30

Answer all questions.

1. A left circularly polarized beam ( $\lambda_0 = 5893 \text{ \AA}$ ) is incident on a quartz crystal (with its optic axis cut parallel to the surface) of thickness 0.022 mm. Determine the state of polarization of the emergent beam. For quartz,  $n_o = 1.54425$  and  $n_e = 1.55336$ . [4]
  2. Describe with the help of schematic diagram the methods of production of linearly polarized light waves. [4]
  3. Discuss the twin image problem of in-line holography and mention some of the applications of holography. Also, write names of the recording materials used for recording optical holograms. [4]
  4. State Huygens-Fresnel principle and write the expression for Fresnel diffraction integral considering a plane wave incident normally on an aperture. [2]
  5. Consider a monochromatic beam of wavelength  $6000 \text{ \AA}$  incident (from an extended source) on a Fabry-Perot etalon with  $n_2 = 1$ ,  $h = 1.0 \text{ cm}$ ,  $F = 200$ . Concentric rings are observed on the focal plane of a lens of focal length 20.0 cm.
    - (a) Calculate the reflectivity of each mirror.
    - (b) Calculate the radii of the first four bright rings. What will be the corresponding values of  $m$ ? [5]
  6. Calculate the wavelength spread if the frequency spectral width is 7000 MHz and the wavelength is  $5000 \text{ \AA}$ . [5]
  7. Prove that the areas of all the half-period zones are approximately equal. [5]
  8. Write the expression relating diffraction divergence and angular spreading for a given light source of wavelength  $\lambda$ . [1]
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