Indian Institute of Technology Patna

Department of Physics

Mid-semester Examination

Optics & Lasers (PH 201)

Full Marks: 30 **Date: Feb. 22, 2018**

Answer all questions.

1. Derive the expressions for reflectivity and transmissivity of the Fabry-Perot etalon. Explain why the etalon produces better resolution as compared to two-beam interference method. [2+2+2]
2. Define holography and explain the difference between photography and holography. Also, mention some of the applications of holography. [3]
3. What do you mean by missing diffraction orders? What causes the missing orders in a diffraction pattern? [2]
4. Describe the state of polarization (type and handedness) of the following waves.
   (a) $\vec{E} = \hat{e}_x E_0 \sin(\omega t - kz) + \hat{e}_y E_0 \sin(\omega t - kz + \pi/4)$
   (b) $\vec{E} = \hat{e}_x E_0 \sin(\omega t - kz) + \hat{e}_y E_0 \cos(\omega t - kz - \pi/2)$ [2]
5. Horizontally polarized light passes through two ideal linear polarizers with transmission directions making angles of θ and -θ with the horizontal direction. Find polarization state of the emergent light and its intensity as a function of θ. For what values of θ, no light comes from the second polarizer? [4]
6. Calculate the Brewster angle for air-glass interface, $n_1 = 1$ & $n_2 \approx 1.33$. [1]
7. Assuming amplitudes of two plane polarized lights as $a_1 = a_2$ and $\theta = 2\pi/3$. Plot the values of E_x and E_y for different values of time and also describe the state of polarization. [5]

   $E_x = a\cos\omega t$ *and* $E_y = a\cos(\omega t - \theta)$

8. Explain the methods of production of linearly polarized light waves. [3]
9. Consider a circular aperture of diameter 2 mm illuminated by a plane wave. The most intense point on the axis is at a distance of 200 cm from the aperture. Calculate the wavelength. [4]
