PYL 115: APPLIED OPTICS

(1st Semester, 2015-2016)

Minor-I

Duration: 1 hour **Max. Marks: 20**

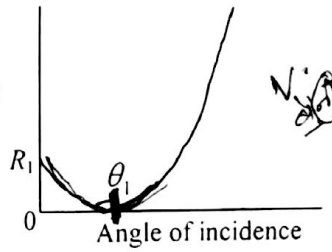
Attempt ALL questions.

1. A 100 W white light lamp with a yellow filter is used as a source to perform Young's double-slit experiment and the fringe pattern is obtained on a screen. To produce a more closely spaced interference pattern, which one of the following action is suitable to follow and why? (3)

   (a) use 10Watt light lamp; (b) decrease slit distance;

   (c) use blue filter instead of yellow; (d) increase the distance of the screen

2. The reflectivity, R, of a plane-polarized wave in air reflected from glass ($n = \sqrt{3}$) is shown in the figure. What is the polarization of the wave? What are the values of R_1 and θ_1 ? Give brief reasons. (4)



3. A crystal has the following dielectric permittivity (4)

$$\varepsilon = \varepsilon_0 \begin{pmatrix} 2.25 & 0 & 0 \\ 0 & 2.25 & 0 \\ 0 & 0 & 1.96 \end{pmatrix}$$

A linearly polarized optical wave that has a free-space wavelength $\lambda = 840$ nm is sent into the crystal. Find the wavelength of the wave in the crystal in each of the following cases.

i) The wave is polarized along $\hat{x}$ and propagates along $\hat{z}$ inside the crystal.

ii) The wave is polarized along $\hat{z}$ and propagates along $\hat{y}$ inside the crystal.

iii) The wave is polarized along $\hat{y}$ and propagates along $\hat{x}$ inside the crystal.

iv) The wave is polarized along $\hat{z}$ and propagates along $\hat{x}$ inside the crystal.

4. An unpolarized monochromatic beam of intensity I_0 is to be converted into a circularly polarized light. Suggest a way of doing this. What is the intensity of the circularly polarized beam? (3)

5. To reduce reflections from a glass surface, it is coated with a quarter wavelength film of a material, which has index lower than that of the glass. Can we use film of thickness equal to an odd multiple of quarter wavelength? If yes, should a thicker film be preferred over the quarter wave film? Give reasons. (3)

6. In the double-slit experiment using white light (400-700 nm), consider two points on the screen, one corresponding to a path difference of 500 nm and the other corresponding to a path difference of 3500nm. Find the wavelengths (in the visible region), which correspond to constructive interference. What will be the color of these two points? (3)