EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE 2005/06 (AUG-SEP. 2007)

FIRST SEMESTER

REPEAT

PH 102 – PHYSICAL OPTICS I

Time: 01 hour.
Answer ALL Questions.

---

1. What are the conditions necessary to observe the interfering fringes in a Young's double slit experiment? Draw a suitable diagram with usual notations to illustrate the Young's double slit experiment and derive an equation for the phase difference of the interfering beams.
State the conditions for obtaining bright and dark fringes and deduce the equation to find the fringe width β.

   A beam of light consisting of two wavelengths $6500A^0$ and $5200A^0$ is used to obtain interference fringes in a Young's double slit experiment. The distance between the slits is $2mm$ and the distance between the plane of slits and the screen is $10mm$.
   i. Find the distance of the third bright fringe on the screen from the central maximum for $\lambda = 6500A^0$
   ii. What is the least distance from the central maximum when the bright fringes due to both the wavelengths coincide?

2. (a) Sketch a diagram for the experimental arrangement for Newton's rings when convex side of a convex lens placed on a glass surface

   (b) Show that the diameter of the dark ring in the Newton's ring experiment is given by

$$d_m^{\,2} = (4R\lambda)m$$

   Where d_m is the diameter of the m^{th} order dark ring and R is the radius of the curvature.

   In a Newton's ring experiment the diameter of the 5^{th} dark ring is reduced half of its value on introducing a liquid below the convex surface. Calculate the refractive index of the liquid.

   You may assume the following expression for the path difference between two rays

$$\Delta = 2\mu d\cos\theta - \frac{\lambda}{2}$$

   where the symbols have their usual meanings.