Final Exam | Physics 223 | 16 June 1997

I--- A plano-convex lens(n = 1.50; radius of curvature = 3.00m) rests on a flat glass plate of n = 1.60 (Fig. 1). Newton's rings are observed in the air wedge (index n_2) by reflected red light of λ = 632.8 nm at normal incidence.

1. (a) Find in terms of λ, R and n_2 the radius x_k of the k^{th} dark fringe.
   (b) Find the color of the central fringe;
   (c) Calculate the radius of the 10^{th} dark fringe;
2. If liquid of index n =1.55 fills up wedge between lens and plate, find the
   (a) Color of the central fringe;
   (b) **Order** and **color** of fringe having same radius as fringe 1(c).
3. Consider the basic setup (fig.1). Raise the lens perpendicularly by a distance t_o = 1.0μ above the plate, find:
   (a) order and color at center
   (b) radius of first dark fringe
   (c) **Order** and **radius** of 10^{th} dark fringe.

II- Natural light is incident at 75° on a plane parallel plate of glass(n = 1.56). Find the degree of polarization of the light transmitted through the plate.

III- A monochromatic plane wave of natural light is incident on a crystalline flat plate of thickness t = 1.0 cm and indices n_O = 1.544 & n_e = 1.553 (Fig. 2).

1. Using Huygens' construction trace the refracted rays with vibration directions.
2. If the reflected light is completely linearly polarized, find:
   (a) The angle of incidence i
   (b) The lateral, perpendicular separation of the emerging rays.

$$r_\perp = \frac{n_1 \cos i - n_2 \cos r}{n_1 \cos i + n_2 \cos r}; r_\Pi = \frac{n_2 \cos i - n_1 \cos r}{n_2 \cos i + n_1 \cos r}; t_\perp = \frac{2n_1 \cos i}{n_1 \cos i + n_2 \cos r}; t_\Pi = \frac{2n_1 \cos i}{n_1 \cos r + n_2 \cos i}$$

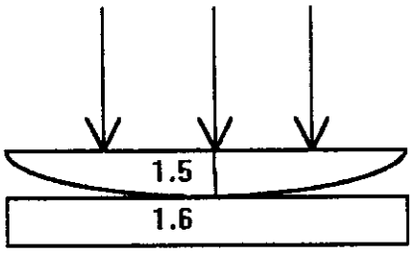

Fig. 1

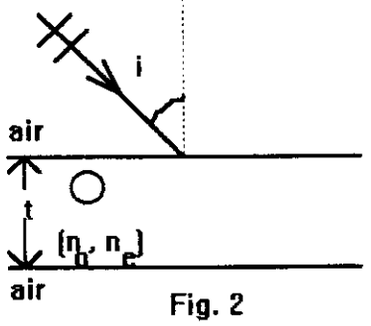

Fig. 2