# PHYS 306 Spring 2010
# Wave Motion and Electromagnetic Radiation

## Test 2

April 15, 2010

**There are five questions. You need to answer four of them. You must indicate which one of the five you omit.**

1. Standing waves are formed on a stretched string under tension of $10^6$ dyn. The mass per unit length of the string is 0.1 g/cm. The length of the string is 50 cm. If it vibrates with five loops,
(1) What is the wavelength of the standing wave?
(2) What is the wave velocity along the string?
(3) What is the angular frequency of the vibration?

2. In Young's double-hole experiment, the distance between the two holes is 1.0 mm, $\lambda=5\times10^{-5}$ cm, and D = 100 cm.
(1) What will be the fringe width?
(2) Calculate $I/I_{max}$ where I represents the intensity at a point where the path difference is $\lambda/5$?

3. (1) Consider a nonreflecting film of refractive index 1.60. Assuming that its thickness is $8\times10^{-6}$ cm. Calculate the wavelength (in the visible region) for which the film will be nonreflecting?
(2) In the Michelson interferometer arrangement, if one of the mirrors is moved by a distance 0.06 mm, 200 fringes cross the field of view. Calculate the wavelength?

4. For a scanning Fabry-Perot Interferometer, the transmitted interference pattern is described as, for a normal incidence,

$$T=\frac{1}{1+F\sin^2\frac{\delta}{2}};\quad \delta=\frac{4\pi h}{\lambda_0}$$

(1) For what $\delta_m$, the transmittivity T equals 1?
(2) Show that

$$\Delta\delta=\frac{4}{\sqrt{F}}$$

in which, $\Delta\delta$ represents the FWHM of the transmittivity; in other words, T=1/2 at $\delta=\delta_m+\Delta\delta/2$
(3) Show that the spectrum resolution

$$\left|\Delta\lambda_0\right|=\frac{\lambda_0^{\,2}}{\pi h\sqrt{F}}$$

5. A convex lens of focal length 50 cm is placed after a slit of width 0.6 mm. If a plane wave of wavelength 6000 Å falls normally on the slit, calculate the separation between the first minima on either side of the central maximum.