PHYSICS 122 **Name:**
Spring 2009
Exam 2

The exam is worth 100 points. Some of the equations are given below.

Interference:
(constructive)
$|d_2 - d_1| = m\lambda \quad m = 0, 1, 2,$
(destructive)
$|d_2 - d_1| = (m + \frac{1}{2})\lambda \quad m = 0, 1, 2,$
As light goes from medium 1 to medium 2

$$\frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = \frac{c/n_1}{c/n_2} = \frac{n_2}{n_1} \qquad n_1 \sin\theta_1 = n_2 \sin\theta_2$$

If the first medium is air, and the next has an index n
$\lambda_n = \frac{\lambda}{n}$
Critical angle
$\sin\theta_c = \frac{n_2}{n_1}$ (for $n_1 > n_2$)
Mirror, lens

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \qquad M = \frac{h'}{h} = -\frac{s'}{s}$$

Focal length of convex mirror, concave lens is negative.
Focal length of concave mirror, convex lens is positive

Thin Films (for both reflected waves in the same phase, i.e., 0, 2 phase changes)

Constructive Interference $\quad 2t = m\frac{\lambda}{n} \quad (m = 1, 2, ...)$

Destructive Interference $\quad 2t = \left(m + \frac{1}{2}\right)\frac{\lambda}{n} \quad (m = 0, 1, 2, ...)$

1nm = 10^{-9} m, 1mm = 10^{-3} m

Young's Double Slit
There are fringes below and above the central bright fringe.

$d \sin\theta_{\text{bright,m}} = m\lambda \quad (m = 0, 1, 2, ...)$

$d \sin\theta_{\text{dark, m}} = \left(m + \frac{1}{2}\right)\lambda \quad (m = 0, 1, 2, ...)$

Small Angle approximations below give θ values in radians!

$y_{\text{bright, m}} = \left(\frac{m\lambda L}{d}\right)$ (small angles)

$y_{\text{dark, m}} = \left((m + \frac{1}{2})\frac{\lambda L}{d}\right)$ (small angles)

$\theta_{\text{bright}} = m\lambda / d \quad (m = 0, 1, 2, ...)$

$\theta_{\text{dark}} = \left(m + \frac{1}{2}\right)\lambda / d \quad (m = 0, 1, 2, ...)$

(m= 0 dark fringe is above central bright fringe)

Single Slit Diffraction
Minima, Dark fringes
$a \sin\theta_p = p\lambda \quad (p = 1, 2, ...)$

For small angles $\frac{\lambda}{a} \ll 1$

$y_p = \left(\frac{p\lambda L}{a}\right)$ (small angles)

$\theta_p = \left(\frac{p\lambda}{a}\right)$ (small angles)

Diffraction grating. (Small angle approx. cannot be used.)
$d \sin\theta_{\text{bright, m}} = m\lambda \quad (m = 0, 1, 2, ...)$

$y_m = L \tan\theta_{\text{bright, m}}$

You see narrow bright fringes. So no "dark fringes"