Phys 375 – Tuesday section – Prof. Hall
Homework #6, due November 13, 2006

1) (5 points) Pedrotti, problem 11-1.

2) (5 points) Pedrotti, problem 11-3.

3) (5 points) Pedrotti, problem 11-4.

4) (9 points) In class we saw that the electric field amplitude for a double slit diffraction pattern is given by

$$E_P = \frac{E_L}{r_0} e^{i(kr_0 - \omega t)} \left[\int_{-(a+b)/2}^{-(a-b)/2} e^{iks\sin\theta} ds + \int_{(a-b)/2}^{(a+b)/2} e^{iks\sin\theta} ds \right]$$

where a is the slit spacing and b is the slit width. Evaluate the integrals and show that

$$E_P = \frac{2E_L b}{r_0} e^{i(kr_0 - \omega t)} \frac{\sin\beta}{\beta} \cos\alpha$$

where $\alpha = \frac{1}{2} ka\sin\theta, \beta = \frac{1}{2} kb\sin\theta$.

5) (9 points) Sketch the diffraction patterns that you would observe on a screen 100 cm from an aperture illuminated by a He-Ne laser, for the following cases:

a) single slit, slit width = 20 microns.
b) double slit, slit width = 20 microns, slit spacing = 80 microns.
c) four slits, slit width = 20 microns, slit spacing = 80 microns.

Draw these diffraction patterns on a one-to-one scale as you would see them on the screen, and label the position of the first zero due to the "slit width" term.