Homework 13 — due 6 Dec. 2006 by 5pm
PH462 EM Waves and Optical Physics — posted: 1 Dec. 2006

1) From the last HW: HM Problem 12-14.

2) A collimated laser beam with the following electric field profile is incident on a lens with focal length f: $E_{in}(r) = E_0 \exp[-r^2 / w^2]$. Use Cartesian coordinates to calculate the Fraunhofer diffraction pattern at the focal plane of the lens. Express the new spot radius as a function of the wavelength, f and w. The "radius" at the input and output is characterized by the radial distance to the $1/e$ point of the field. You may neglect the truncation of the input field by the edges of the lens.

3) A beam is propagating inside a high-order mode of a rectangular waveguide with the field profile:
$$E(x,y) = E_0 \sin\left(\frac{m\pi x}{a}\right)\sin\left(\frac{n\pi y}{b}\right)$$
It leaves the waveguide and propagates in free space. Calculate the far-field intensity pattern using the Fraunhofer method. Compare the angles of the maxima of the pattern to the internal ray angles for the mode inside the waveguide.