Homework # 6

PHYS 355 (Mendes, fall 2009)
(due in class on Oct 28)

(10 points)
1) A convex lens of focal length 20 cm is placed after a slit of width 0.6 mm. If a plane wave of wavelength 600 nm falls normally on the slit, calculate the separation between the second minima on either side of the central maximum.

(10 points)
2) A circular aperture of radius 0.01 cm is placed in front of a convex lens of focal length 25 cm and illuminated by a parallel beam of light of wavelength 500 nm. Calculate the radii of the first three dark rings on the focal plane of the lens.

(10 points)
3) Consider a plane wave incident on a convex lens of diameter 5 cm and of focal length 10 cm. If the wavelength of the incident light is 600 nm and the incoming beam is at normal incidence, calculate the radius of the first dark ring on the focal plane of the lens. Repeat the calculations for a lens of the same focal length but with diameter of 15 cm. In both cases consider the lens to be free from any optical aberration (“perfect” lens).

(10 points)
4) Calculate the diameter of a telescope lens if a resolution of 0.1 second of arc is required at the wavelength of 600 nm.

(10 points)
5) Assuming that the resolving power of the eye is determined by diffraction effects only, calculate the minimum separation between two objects that can be resolved by the eye when the objects are located at a distance of 25 cm in front of the observer. (Assume pupil diameter of eye to be 2 mm and visible wavelength centered at 550 nm)