PHYS 471: Optics

# Midterm examination

February 29, 2008

Open books. Attempt all problems. Each problem is worth 25 points. Partial credit will be given. All answers must be given both in symbolic and numeric forms.

<u>Problem 1.</u> A fish sees the sun at angle $\beta = 60°$ above the horizon. What is the actual angle of the sun's position above the horizon? The index of refraction of water is $n = 4/3$.

<u>Problem 2.</u> What fraction of the solar radiation power will reflect from the water surface under the conditions of the previous problem?

<u>Problem 3.</u> Two perfectly stable laser beams of wavelength $\lambda = 632$ nm overlap at angle $\alpha = 1°$ (Fig.).

a) Find the period of the interference fringes observed on the screen.

b) What can be said about the coherence time of the lasers?
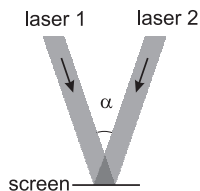
<u>Problem 4.</u> Observing an object through a lens you see a virtual image reduced in size by a factor of $M = 2/3$. The distance between the lens and the object is $s = 3$ cm.

a) Find the image distance s'. Is the lens converging or diverging? Find the focal length f.

b) Draw a ray diagram showing the formation of the image.

c) Is the image erect or inverted?