General College Physics II (PHY 104)

Practice Exam 3

Question 1 (4 points) You are invited over to the King's palace on Saturday night. After a sumptuous vegetarian meal, you offer to help clean the enormous serving dishes used during the feast. One of these dishes is a perfectly hemispherical silver bowl one meter in diameter. After cleaning the bowl, you can see your reflection in it. From far away, your reflection is upside down. As you get closer, there is a place where your reflection becomes right side up. How far from the bowl surface does your reflection change from upside down to right side up? Why does this happen?

Question 2 (4 points) OPTOFLEXIMAGICSTUFF is a new brand of transparent, flexible plastic with an index of refraction of 1.2. The suggestion is made to make fiber-optic cable for underwater use out of this new material. The material performs well as fiber-optic cable when tests are carried out in air. When the material is submersed in water, however, it performs horribly. Explain why.

Question 3 (4 points) If you shine laser light through a single slit, you get a diffraction pattern on the wall. The diffraction pattern consists of bright and dark fringes. Explain what happens to the diffraction pattern if the slit width is decreased.

Question 4 (4 points) Consider a converging lens with focal length 20 cm. An object is placed 5 cm in front of the lens. Make a ray diagram that shows where an image would be formed. Is the image real or virtual? Is it inverted or upright?

Problem 1 (8 points) An object is placed 10 cm in front of a converging lens with focal length 20 cm. Where is the image formed? Is the image on the same side as the object or the opposite side? Is the image real or virtual? Is the image upright or inverted?

Problem 2 (8 points) In a two-slit interference experiment, if light with wavelength 600 nm goes through two slits separated by a distance 0.5 mm and reaches a screen 2 m beyond the slits, how far apart will the interference fringes be on the screen?

Problem 3 (8 points) Consider a thin film interference situation in which we want reflected light of wavelength 500 nm to interfere constructively when it hits a 200 nm thin film on top of a glass substrate with index of refraction 1.5. Find the two smallest indexes of refraction for the thin film that could be used to achieve the interference we want.