PHYSICS 232 – SAMPLE TEST # 2

Problem 1

A totally absorbing surface of area $A = 7.7$ cm^2 faces a small source of sinusoidal electromagnetic radiation that is 4 m away. At the surface A, the electric field of the radiation has amplitude $E_0 = 19$ V/m.

(a) What is the intensity of the radiation on the surface?

(b) Calculate the radiation pressure and force exerted on the surface.

(c) What is the total power output of the source, if it is assumed to radiate uniformly in all directions?

Problem 2

A ray of light traveling in air makes a 63^o angle with respect to the normal of the surface of a liquid. It travels in the liquid at an angle of 40.9^o with respect to the normal. (Assume $n = 1$ for air.)

(a) What is the index of refraction of the liquid?

(b) What is the critical angle for total internal reflection?

Problem 3

Three linear polarizers are oriented as follows: The axis of the second is at an angle of 59^o relative to the first. The axis of the third is at an angle of 31^o relative to the second (so the axis of the third polarizer is perpendicular to the axis of the first). Unpolarized light of intensity $I_0 = 79.4$ W/m^2 is incident on the first polarizer.

(a) What is the intensity of the light after it passes through the first polarizer? Justify your answer.

(b) What is the intensity of the light after it passes through all three polarizers?

(c) Remove the second polarizer. What is the intensity of the light after it passes through the remaining two polarizers? Explain.

Problem 4

An object of height $y = 2$ mm is placed at a distance $s = 50$ cm to the left of a converging lens of focal length $f_1 = +20$ cm. A diverging lens of focal length $f_2 = -10$ cm is 15 cm to the right of the first lens.

Calculate the location (relative to the second lens), nature (real or virtual), orientation (erect or inverted), and height of the final image by the pair of lenses.

Problem 5

A diffraction grating is to be used to find the wavelength of the emission spectrum of a gas. The grating spacing is not known, but a light of a known wavelength of 632.8 nm is deflected by 43.2^o in the second order by this grating. Light of the wavelength to be measured is deflected by 53.4^o in the second order. What is the wavelength of this light?