PHY 353S - Electromagnetic Waves

Mid Term Test

4 pm, Wednesday 30th March 2000.

This Test is "Open Book"

1) Explain the differences between group velocity and phase velocity?

2) Linearly polarized light is incident on a 1/2 wave plate at 45° to the plates axes. Using Jones matrices, calculate the polarization of the resulting beam.

3) An engineer is designing a spacecraft with a disc shaped highly-reflective solar sail. A laser is pointed at the spacecraft from the Earth in order to propel the craft. What power of laser is required to generate a thrust of 1 N.

4) A sunbeam of randomly polarized light is incident on a pond at the Brewster angle. What is the ratio of reflected light energy to transmitted light energy. [the refractive index of the pond is n=1.33].

5) A monochromatic laser beam (wavelength 550 nm, travelling in vacuum) is split equally into two. The beam are recombined but one beam has traveled 0.5 cm further than the other. If the form of the coherence function is

$$\gamma_{12}(\tau) = \exp(-i\omega\tau)\exp(-|\tau|/\tau_0),$$

and the coherence time of the laser is 10 pS, what is the intensity at the point of recombination?