Modern Interferometry

Preparatory questions part I

1. In this experiment you will be using a number of optical elements. Briefly explain the principle of operation for each of the following components:
   a. Laser
   b. Photo-detector
   c. Polarizer
   d. Cube beam splitter

2. Explain the principle of operation of the Michaelson interferometer. How could Michelson and Morely detect the presence of the ether using this interferometer?

3. What happens when a piece of glass (or other transparent material) is placed in one arm of the Michelson interferometer.

4. Explain the principle of operation of the Sagnac interferometer. How is it different from the Michaelson interferometer? The Sagnac interferometer can be used to measure the rotation of a frame of reference by carrying out an optical measurement within this frame. Explain how this is done for detecting the rotation of the earth.

5. In the Sagnac interferometer that you will build in this lab you can achieve a sensitivity of 0.05 fringes. Estimate the minimum interferometer arm length needed in order to be able to detect the rotation of the earth.

6. Explain the principle of operation of the Mach-Zender interferometer. Discuss how it differs from the Sagnac interferometer, its advantages and disadvantages.

Preparatory questions part II

1. How can one measure the wavelength of light using interferometry.

2. What is the coefficient of thermal expansion. Which type of interferometer is well suited to measure it. Explain why.

3. Explain electrostriction and piezoelectricity. Which types of interferometers are well suited to measuring these quantities. Explain why.
4. Explain magnetostriction. Which type of interferometer is well suited to measuring this quantity. Explain why.

5. List 3 other quantities that can be measured with interferometers. Explain your answer.