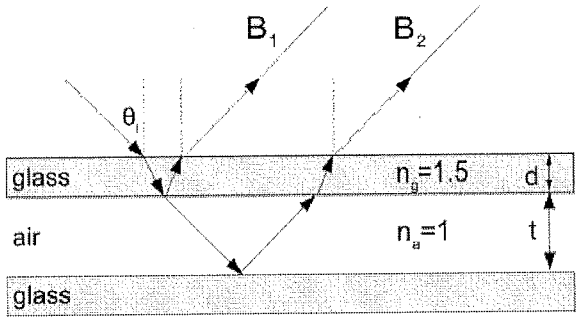
[Answer in Finnish, Swedish or English]

1. Explain **briefly**:

   A) FTIR
   B) Optical activity
   C) Van Cittert-Zernike theorem
   D) Explain a way to make an optical isolator

2. A beam of white light (a continuous spectrum from 400 to 700 nm) is incident at an angle of $\theta_i = 45^\circ$ on two parallel glass plates (see figure below). The thickness of the glass plates is $d = 5$ μm and they are separated by a $t = 10$ μm-thick air film. The reflected light (beams B1 and B2) is admitted into a prism spectroscope. How many dark lines are seen across the entire spectrum?



3. **A)** Consider the two cases where

   (i) a plane wave travels in vacuum over a distance L,

   (ii) a plane wave travels a distance L-d in vacuum and a distance d in a dielectric material with refractive index n.

   What is the phase difference between these two cases?

   B) True or False:

   (i) When light is incident upon a material interface at Brewster's angle, only one polarization component can *transmit*. T or F?

   (ii) When p-polarized light enters a material at Brewster's angle, the *intensity* of the transmitted beam is the same as the intensity of the incident beam. T or F?

   (iii) From any given location beneath a (smooth flat) water surface, it is possible to see objects positioned anywhere above water. T or F?

4. A wave plate is sandwiched between crossed polarizers. The optic axis of the wave plate is inclined at 45° to the axes of the polarizers. The wave plate causes a phase shift of ϕ between the components parallel and perpendicular to its own axis. Show that the transmittance of the system is $\sin^2(\phi/2)$ when the incident beam is polarized pa-

rallel to the first polarizer. What is the transmittance when the axes of the polarizers are parallel?

5. **A)** The complex degree of coherence of a He-Ne laser is

$$\gamma(\tau) = e^{-i\omega\tau - |\tau/T|},$$

where T = 10 ns. The laser is used to construct a Michelson interferometer. How large can the path difference between the two arms be, if 50% visibility is required?

B) What is Michelson's stellar interferometer? How does it function and what can it be used for?