Examination in Optical physics 110112

All examination aids except those which provide contact with the outer world are allowed. Draw figures whenever possible!

1-2

Construct (in thin lens approximation) a telescope with zoom so that the angular magnification can be varied between 6x and 12x in the extremal positions.
One ray diagram for each extremal position is required. All focal lengths, lens diameters and distances should be marked in the diagrams. Verify that the exit pupil shall be placed outside the telescope for all magnifications, and calculate the size of the exit pupil in the extremal positions. The field of view must be more than 3.5° with the 12 x magnification (verify!) and no lenses can have f-numbers smaller than 1.5.

3

The phase difference between the two polarisation components changes when a beam of light is total internally reflected. How should the incident angle be chosen in order to generate a phase shift of $\pi/4$? Why would a phase shift of $\pi/4$ be of specific interest? n= 1.56. Last step may be done numerically.

4

A plate of germanium (n=4) is used to polarize far infrared radiation by passing/reflecting a beam at Brewster angle through the plate. How many per cent of the incoming light is reflected? None of the sides have any coating.

5

A beam of light (λ = 589 nm) that is transversely incoherent but longitudinally coherent is passed through a Fabry-Perot etalon with n= 1.54. The light passes through an f= 200 mm lens and the interference pattern is observed in the back focal plane of the lens. 40 bright rings are observed inside a radius of 30 mm. How thick is the etalon?

6

In a fourier optics experiment the diffraction pattern of a double slit is studied. The cc-distance between the slits is three times the width of each slit. The central maximimum and the first maximum to each side is blocked in the fourier plane. Sketch the filtered image, in the image plane of the double slit.

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