

Examination in Optical physics for F4 071022

All examination aids except those which provide contact with the outer world are allowed.

1

An ordinary 7x telescope (=binoculars) can be used as a magnifier for objects close to the eye-piece if you look through the objective (turn the telescope around!) Consider a 7x telescope with 20 mm eye-piece (two lens eyepiece) and an object 10mm from the first lens in the eye-piece. Where will the image be and how much is it magnified (transverse magnification)?

2

For far infrared radiation there are no polarizers working in the same way as they do in the visual range. An uncoated, 10mm thick plate of CdTe ($n=4,9(!)$) can be used instead. What is the total reflectance for the two directions of polarization when oriented for maximum polarization of the reflected light?

3

Sketch (diagram with graded angle-axis) the Fraunhofer diffraction pattern from a row of 100 circular apertures with diameter D and cc-separation $3D$.

Wavelength is assumed to be known.

Only intensity along the direction of the row must be sketched.

4-5 (two points for full solution)

The ideal (?) AR-coating would be a layer with a gradual increase in index of refraction from the first medium (on the incidence side) to the other medium. For interfaces between liquids and solids this can be realized. Why not for interfaces air-glass?

What will the reflectance be if medium 1 has $n_1=1.50$ and medium 2 has $n_2=2.00$ and the AR-coating has a linear increase in index of refraction over 100 wavelengths?

List at least three advantages of this kind of coating as compared to the normal multilayer stack.

.... infinitesimally small reflections from infinitesimally thin layers...

6

On the attached sheet you find a drawing in scale 1:1 of a somewhat complicated camera objective ☺ .

Find (by any method you want) the system focal length, the back vertex focal length and the position of the aperture stop.

You may draw directly in the drawing which you hand in with the exam.

Write your mail address on the envelope!!!

