Examination in Optical physics for F4 080114

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

1

A microscope has an objective with f_1 = 5 mm and D_1 = 4mm, a field lens with f_2= 25mm and D_2 = 16 mm placed 200 mm from the objective, coinciding with the intermediate image. The last lens (the eye lens) has f_3= 20mm and D_3 = 8 mm. The final image is in infinity.

Find and determine the size of: Entrance pupil, exit pupil and field of view (in mm).

2

Find the system focal length and the position of the front focal plane for the above system.

Use the system focal length to determine the magnification with the conventional loupe formula (250 mm / f). Compare this with the magnification of the microscope calculated in the conventional (for a microscope) way.

3

Find the resolution (Rayleigh's criterion) calculated with the help of

A/ the entrance pupil and with

B/ the help of the exit pupil.

How can you make these two values describe the same thing?

4-5

A Twyman-Green interferometer is perfectly adjusted except that one of the mirrors is slightly tilted so that a linear fringe pattern can be observed. The beam splitter is polarizing so that TE light is always transmitting and TM light always reflecting (perfectly ☺). In each of the interferometer arms a $\lambda/4$ plate is placed (with optical axis 45° to the incoming polarization).

Finally, after rejoining the beams in the beamsplitter, a polaroid with transmission axis in 45° is placed.

The incoming light is perfectly coherent and linearly polarized in 0°, 45° and 90° respectively. What will be the visibility of the fringe pattern in the three cases?

6

A simple lens is made as a glass hemisphere with index of refraction 1,70 and radius r. A plane wave of light enters from the planar side. Follow the most peripherical ray that passes through the lens and determine where it crosses the symmetry axis. Compare with a paraxial ray.

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