

## Examination in Optical physics 091019

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

### 1-2

An endoscope is an instrument formed as a tube, intended to relay an image for example for a surgeon looking into the human body without cutting too large incisions.

A typical example is made from units of four  $f = 5$  mm lenses placed 10mm apart. Several such units can be placed after in other, with 10 mm in between them. 10 mm after the last unit an  $f = 10$  mm lens is placed. Final image at infinity for doctors eye comfort.

All lenses have diameter 4.0 mm and can be assumed to be thin.

Where should the object be placed?

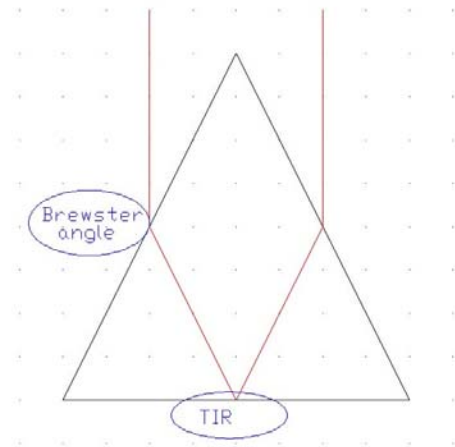
What is the magnification of this system (defined as for the loupe)?

What is the field of view ( in mm )?

Where are entrance pupil, exit pupil and aperture stop placed?

### 3

Look at the prism with red light rays to the right. There are two Brewster angle refractions and one total internal reflection. What condition is there on  $n$  for this to be possible, and how large should the top angle of the prism be (expressed in  $n$ )?



### 4

In a Twyman Green interferometer a polarizing beam splitter is used that transmits on polarization direction (vertical) and reflects the other (horizontal). The light from the laser is polarized in  $45^\circ$  between hor. and vert. In each arm a  $\lambda/4$  plate with optical axis 0,  $45^\circ$  or  $90^\circ$  is placed. What will be the visibility of the interference pattern for the different angles?

### 5

The diffraction blur in a microscope can be calculated either by Diffraction in the objective forming a circular spot as intermediate image of a point object and then geometrical imaging through the eyepiece

Or as

Diffraction in the exit pupil

Show that these methods give the same image on a retina of an observer

(Final image from microscope assumed to be in infinity). Use a simple two lens model of a microscope

### 6

An object in a fourier-optical  $4f$ -setup is formed as a transmitting  $N$ . Sketch the fourier transform.

Write your mail address on the envelope!!!