

Examination in Optical physics 081020

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

1

A lens with $f = 80\text{mm}$ and diameter 40mm is used to view an object. The distance between the lens and the eye is 200mm and the image from the lens is at infinity. What is the field of view (in mm)?

2

An instrument (used in othology, but that is inconsequential) has the following properties

Object at $z = 0\text{ mm}$

Lens with $f = 40\text{ mm}$ at $z = 40\text{ mm}$

Lens with $f = -160\text{ mm}$ at $z = 160\text{ mm}$

What is the magnification of the object and where can we find the image?

3-4

Light emitting diodes (not laser diodes) give fairly monochromatic light (say $640\text{ nm} \pm 5\text{ nm}$) and the light is emitted from an area $20\text{ }\mu\text{m} \times 20\text{ }\mu\text{m}$. The light diverges from the source with an angle $\pm 10^\circ$ and is then collimated (= made as parallel as possible) with an achromat at the size desired. Use $f = 100\text{mm}$ in this case. Can the diode be used as light source just replacing the laser in the type of "laser Michelson" built in the lab? Why? / Why not ?

Can any modification of the interferometer be done so that this light source works better?

5

Laser beams are often called Gaussian beams because the field distribution is given by

$$E = E_0 \exp\left[-\left(\frac{r^2}{r_0^2}\right)\right]$$

Calculate the divergence angle from this and the diffraction integral in the Fraunhofer approximation.

Divergence angle is defined as the angle describing the increase of r_0 as the beam propagates.

6

A wave plate with phase difference 2π for $\lambda = 550\text{nm}$ is used between crossed polarisers. What will the transmission be for 440 nm and for 550 nm ?

Write your mail address on the envelope!!!