Lösningsförslag till tentamen i Optisk fysik 021022

1-2

The eye lens is obviously 220mm from the objective, and that is where the 200mm lens is placed. This means that the fourier plane should be 20mm after the objective having a focal length of 5mm.
The fourier plane is the focus of the illuminating laser beam e g the 10mm lens together with the objective should give a focus 20mm after the objective. Then the first focus is the object of the second and should be 6,7mm before the objective.
Finally the focussing lens has f=10mm givíng a total of 16,7mm between lens and

3

This is obviously defocussing. The film plane is at 50,50mm distance from the lens.
The lens formula for more distant objects:
Det har uppenbarligen med defokusering att göra.

$$\frac{1}{a'}+\frac{1}{b'}=\frac{1}{f}\Rightarrow b'=\frac{a' f}{a'-f}$$

Calling the diameter if the blur circle d, and the diameter of the lens (entrance pupil) d:

$$\frac{d}{D}=\frac{b-b'}{b'}$$

The image sizes of the stripes are h'=b'/a' h
When this is equal to the blur circle diameter the visibility of the stripes is zero.
After some work :-)

$$a'^2\left(Db-Df\right)+a'\left(f^2D-2Dbf-f^2h\right)+f^2Db=0$$

Which gives a'=8,3m and another solution corresponding to the near limit which is not asked for.

4

The incidence angle is above teh Brewster angle which means that one of the poilarization components get a phase shift of pi. The amplitude reflectivities is calculated with Fresnels formulas and b=41°.
r(TM)=0,47 och r(TE)=0,72
Vi now have two components half a period out of phase i e still LP but the angle is now 57°

5

The power of the system is calculated as

$$\frac{1}{f_{syst}}=\left(n_g-1\right)\left[\frac{1}{R_1}-\frac{1}{R_2}+\frac{\left(n_g-1\right)d}{n_g R_1 R_2}\right]\Rightarrow f_{syst}=169mm$$

The distance from surface to respective principal plane can be calculated from 6.36 in the book

$$V_1H_1=\frac{dP_2}{n_g}f_{syst}=5{,}4mm$$

For teh positive surface, and 10,8mm for the negative. The principal planes are 0,4mm from each other and 5mm from the lens in the "convex" direction

6

The most important effect is that the visibility goes down because there is more light from the larger slit. V=0,94.