Solutions to exam in Optical Physics 051024

1-3

There are of course many possible solutions to this problem. Here only some guidelines will be given.
The object distance is 51,3mm = distance between DMD and projection lens.
The condensing lens should image the lamp on the colour wheel and the shaping lens should image the color filter onto the projection lens. The size of the lenses should be large enough to illuminate the DMD which is something like 12mm x 12mm (depending on what number of pixels you have assumed). The size of the lens is trickier. If you want the pixel to be invisible you can choose to make the lens at the Rayleigh condition which vill be 2mm I diameter. But what you really want is to make the borders between the pixels invisible. Any assumption here is OK , but if you assume a 1 µm border the lens will be like 20mm I diameter.

4

First we observe that the light goes into the pixel and out of the pixel through the same polariser, meaning that the state of polarisation must be the same if light is to pass. That means that any even multiple of π for 450nm will make blue light pass. Red light sees a smaller phase shift so e g 600nm will se 1,5 π if we have 2π for 450nm. That will not make the color blue!
Choosing 4π for 450 nm will put the minimum at 600nm which is pretty much in the middle of the wavelength interval we wish to suppress.

5

Start by observing that this is not a symmetric Fabry Perot so the formulae at pp416-421 are not applicable. 9.101 is however OK

$$R = \left(\frac{1{,}79 - 1{,}36^2}{1{,}79 + 1{,}36^2} \right)^2 = 2{,}7 \cdot 10^{-4}$$

(It is “easily” derived if you did not find it)

6

Blue or red tint in the perifery of the image.