Biomicroscopy I - Solutions Exercise Sheet 14

December 17, 2024

1 Bonus question: Siemens star in a $4f$ system

The filter is a band-pass, where high and low frequencies are removed from the source image. Since the center, corresponding to "0" spatial frequency, is dark, the background will be removed. This means there will be no clear dark and bright areas, and only transitions (or edges) will be visible. The periphery of the filter is also dark, thus removing high spatial frequencies of original image. These high frequencies are in the center of the original image, so the center of the resulting image will be (almost) completely black. Therefore, the answer is option **b.**.

2 Bonus question: fluorescence microscopy

A. LED, Metal halide lamp, Laser

B. CMOS/CCD, PMT, APD

C. DAPI, FITC, Cy3, Alexa 488

3 Bonus question: diffraction grating

Longer wavelengths λ symmetrically diffract more and will thus be found farther away from the central peak, corresponding to w. As $\lambda_r > \lambda_g > \lambda_b$, the correct answer is option **c**.

4 Bonus question: aberrations

A. In Fig. (a) ideal image gets distorted only for horizontally oriented pattern meaning that the optical system has different focusing for longtitudal and transversal directions. This type of abberations is called **astigmatism**.

B. In Fig. (b) perfect circles get the 'tails' in the distorted image pointing out of the centre. This type of the image is called **coma aberration** (probably for its similarity with a comet or a comma, whatever is more convenient to remember :)).

C. In Fig. (c) one can notice that the borders of the image has color dispersion which is the result of different focusing for different incoming wavelength. This type of distortion is called **chromatic aberration**.