Course analysis Microscopy SK2500/SK2501/FSK3500/FSK3501 HT 2019

Number of credits: 6p for SK2500/FSK3500, 7.5 p for SK2501/FSK3501 (4 p exam A-F, 2 p labs P/F, 1.5 p seminar P/F on SK2501)

Course responsible: Anna Burvall and Ilaria Testa, both on lectures and labs

Other teachers: -

Teaching hours: 26h lectures, 16 h labs, 4 h seminar (SK2501/FSK3501 only)

Number of registered students: 11 on SK2500, 2 on FSK3501, 0 on SK2501 and FSK2500

Number of students at exam: 10 + 1 re-reg on SK2500, 2 on FSK3501

Number of pass at exam: 9 + 1 re-reg on SK2500, 2 on FSK3501

Levels of pass: 82% on SK2500, 100% on FSK3501, passes exam after first attempt

           11+2 students (100%) pass on labs

           2 students (100%) pass on seminar (FSK3501 only)

Total pass level: In total 85% pass after first exam

Number or answers to course evaluation: 6 (46%)

Course objectives:

After completing the course the student should be able to:

- adjust the illumination system to obtain optimal performance in transmission microscopy.
- select a suitable light source and optical filters, and correctly adjust the illumination system for fluorescence microscopy.
- select a suitable objective (correction, immersion etc) for various types of microscopic investigations.
- select a suitable contrast method (phase contrast, DIC, fluorescence, darkfield etc) and correctly use this technique to obtain high-quality images.
- calculate the expected image quality regarding resolution and signal-to-noise ratio for different practical imaging situations.
- understand and be able to describe the physical limitations for microscope performance concerning resolution and signal-to-noise ratio.
- describe performance for different types of microscopes by using (and in some simple cases calculating) optical transfer functions.
- select a suitable sampling density for digital image recording in microscopy.
- do computer processing of microscopic images to visualise three-dimensional structures.
- perform quantitative measurements in microscopic images using a computer.

Last year's course (from last year's course analysis)

Last year the course, as a whole, worked fine. No major problems.

This year's course

Judging both from the course evaluation and from the exam results, the course is in good shape. It would be good to have some more students.

Each year we re-arrange which lectures we teach, so that both of us know the whole course content. The exceptions are the two nanoscopy lectures which are Ilaria's specialty and Anna try to attend. This is good and should, if possible, be continued.

Before the course started we changed the mercury lamp on the epi-fluorescence microscope for lab 2. First time, but now we know how to do it. We used the spare lamp, a new spare lamp has been ordered.

A new section on STED imaging was introduced in the course literature. As the emphasis on nanoscopy/superresolution imaging is increased, and such questions are included on the exam, we needed a more extensive material. We got no comments on this part from the students, so we hope the material was sufficient. Next year a section on statistical superresolution methods should be added.

The course evaluation was performed in KTH Forms, using only three questions. This gave a higher response rate (46%) than last year, when we used LEQ, but lower than using printed forms during the exam. The students were, in general, happy with the course. One thought it was a bit slow and wanted more content, while another thought there was too much content. This is typical of a course collecting students from different backgrounds – we have to set the level somewhere in the middle. The students appreciated the labs. Most students also asked for more problems to be solved during lectures, something we'll look into for next year.

Lab 3, using the confocal microscope, is becoming a problem. The confocal microscope at AlbaNova is in bad shape and not maintained. Fortunately, we got some help getting it stared, and then we kept our fingers crossed and everything worked well enough to get results for all groups. Bur we can't go on like this; next year it may not work at all. Ilaria will look into the possibility of using a confocal microscope as SciLife.

For lab 4 we used the new computers in the photo studio, which was fine. Those who wished could also use their own laptops, as the software is shareware.

Several students were unable to attend the scheduled exam. We found a new time that suited all students, and got permission from the school to change the exam to this date. This was probably why so many students (all except one) attended the exam.

Next year's course

Things to develop for next year (as many as there is time for, most important marked in red):

- write notes on statistical superresolution microscopy, to be added in the microscopy compendium.
- Inform the student that if they wish, they can change from SK2500 to SK2501 even after the course has started.
- For lab 3, find out if we can use another confocal microscope.
- Re-write learning outcomes and introduce grading criteria.
- For lab 4, make sure updated versions of ImageJ are installed and running properly.
- We have some spare time during lectures. See if this can be used for solving problems.
- In a longer perspective, the imaging physics compendium should be updated. It wasn't written for this course in the first place. In particular the problems could be updated and better adjusted to the course. A list of relevant problems in the imageing physics compendium should be created.