Course analysis Microscopy SK2500/SK2501 HT 2018

Number of credits: 6p for SK2500, 7.5 p for SK2501 (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: 28 h lectures, 16 h labs, 4 h seminar (SK2501 only)
Number of registered students: 5 on SK2500, 3 on SK2501 + 4PhD students
Number of students at exam: 2 on SK2500, 2 on SK2501 and 4 PhD students
Number of pass at exam: 2 on SK2500, 2 on SK2501 and 4 PhD students
Levels of pass: 40% on SK2500, 67% on SK2501, 100% PhD students passes exam after first attempt

5 (SK2500) +3 (SK2501)+ 4 PhD students (100%) pass on labs
2 students + 3 PhD students (100%) pass on seminar (SK2501 only)

Total pass level: In total 67% pass after first exam
Number or answers to course evaluation: 6 out of 6 that gave the exam
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 visualize 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 lectures were given by Anna Burvall and Ilaria Testa on partially different part of the course. This year we decided to change who gives certain lecture so that each teacher has the complete overview of different topics of the course. The course worked well as a whole.

This year's course

This year, Anna and Ilaria taught the whole course. We split the lectures as: 3 introductory lectures (Anna), 4 lectures on image formation & Fourier and sampling (Anna), 3 lectures on confocal microscopy and aberrations (Ilaria), 2 lectures on super-resolution (Ilaria) and 1 lecture on problem solving (Ilaria). We also split the lab sessions equally.

We had 12 students on the course. Of these, 8 have passed so far (after first exam). From the course evaluation, the students seem very happy about the course. From their comments, they have learnt new things and the learning outcome of the course were perceived well in line with exams and final gained knowledge. So the course worked well, no worries. Still, there are some minor things to fix, see below.

The lectures seem to have gone well, with relatively high attendance. The labs went well too. Lab 1-4 had no major problems. At some point there were some technical problems with the stage of the confocal microscope, but no more (maybe less) than should be expected.

The data analysis (lab 4) was significantly and successfully improved based on the course analysis of last year. The students were happy to bring their laptop and to use open source software Image J to analyze their data. This way we did not encounter problems with file types and compatibility compared to last year.

On lab 3, we added more explanations on the instruction of task 3.

In this year exam there were questions on STED super-resolution microscopy, which the students solved. This is becoming a more important part of the course and should be represented in the examination. Next year we will update the super-resolution part of the compendium with more formula on this part. Ilaria will work on it.

From the exam results we have the impression that it was more balance than last year. All students that attended the written exams passed. Also, the points they gained or lost in each task were evenly distributed, while last year they failed in the same tasks. So the learning outcomes of the course were acquired more homogenously. On the other hand, we were expecting more students to show up at the exam (one had another exam on the same day) so we believe than at the re-exam some more students will attend. If not we will investigate further the reasons of not achieving higher attendance.

Next year's course

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

- we will develop additional materials on super resolution microscopy in the compendium.
- we are thinking to optimize lab1 and lab2 by having more groups of students working simultaneously by adding an additional small microscope and re-organizing the fluorescence part of the primo star fluorescence microscope.
- Keep reminding the students that they can change from SK2500 to SK2501 even after the course has started.
- Lab 4 reminder for students to bring own laptop as this year (worked well).
- As always for lab 2, dismount and check the mercury lamp in the "big, primo-star" microscope.
- In a longer perspective, the imaging physics compendium could 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.
- If the students attending the course next year will start with very different background (Biomedical versus Physics) we could have elective tasks on the exams reflecting the different backgrounds (for example Fourier tasks of different difficulties).