SK2500 Physics of Biomedical Microscopy 6.0 credits

Bildfysik med inriktning mot biomedicinsk mikroskopi

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for SK2500 valid from Autumn 2008

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Engineering Physics

Specific prerequisites

Recommended prerequisites: Basic knowledge of waves, geometrical optics and photometry (course SK1100 or similar). Elementary knowledge of the Fourier transform.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

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.

Course contents

Basic optical layout of the light microscope. Aberrations. Microscope objectives. Magnification. Numerical aperture. Microscope photometry. Detectors. Noise. Contrast methods (fluorescence, phase contrast, DIC). Resolution. Fourier methods. Optical transfer functions. Three-dimensional imaging in microscopy. Sampling and reconstruction of image data. Confocal microscopy. A brief introduction to tunnel and atomic force microscopy, electron microscopy, scanning near-field optical microscopy and X-ray microscopy.

Course literature

Carlsson, K. Imaging physics, KTH.

Carlsson, K. Light microscopy, KTH.

Lab. instructions.

Examination

- LAB1 - Laboratory Work, 2.0 credits, grading scale: P, F

- TEN1 - Examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Written examination (TEN1; 4 credits, grading scale A-F)
Laboratory (LAB1; 2 credits, grading scale P/F).

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.