



# SK2501 Physics of Biomedical Microscopy, Extended Course 7.5 credits

Bildfysik med inriktning mot biomedicinsk mikroskopi, utökad kurs

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Course syllabus for SK2501 valid from Autumn 08

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

**Grading scale:** A, B, C, D, E, FX, F

**Education cycle:** Second cycle

**Main field of study:** Biotechnology, Engineering Physics, Physics

## 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.
- 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.
- extract relevant information from a scientific publication and present this in the form of a seminar.

## Course main content

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.

## Language of instruction

Language of instruction is specified in the course offering information in the course and programme directory.

## Eligibility

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

## Literature

Carlsson, K. Imaging physics, KTH.

Carlsson, K. Light microscopy, KTH.

Lab. instructions.

Scientific publications.

## Examination

- LAB1 - Laboratory Experiments, 2.0 credits, grading scale: P, F
- SEM1 - Seminar, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 4.0 credits, grading scale: A, B, C, D, E, FX, F

## Requirements for final grade

Written examination (TEN1; 4 hp, grading scale A/B/C/D/E/Fx/F), completed laboratory course (LAB1; 2 hp, grading scale P/F) and seminar presentation (SEM1; 1.5 hp, grading scale P/F).