HL2007 Mathematical Methods of 3D Microscopy 7.5 credits

Matematiska metoder för 3D-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 HL2007 valid from Autumn 2007

Grading scale

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

Education cycle

Second cycle

Main field of study

Physics

Specific prerequisites

Bachelor's degree in Engineering physics, Electrical Engineering, Computer Science or equivalent. Basic knowledge of anatomy.

Language of instruction

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

Intended learning outcomes

The main purpose is to introduce basic mathematical methods used in tomography, electron and light microscopy of other forms of biomedical imaging.

After completion of the course the student should:

- Understand Fourier analysis in 2 and 3 dimensions
- Understand the concepts and use of convolution and correlation in 2 and 3 dimensions
- Understand and be able to apply the convolution and the correlation theorem
- Be able to build the Fourier transform of a composite function from the Fourier transforms of its component functions
- Understand and be able to derive the central section theorem
- Understand the concept of pointspread functions and transfer functions and their correction
- Understand sampling theory and the methods of alignment in 2 and 3 dimensions
- Understand multivariate statistical methods as applied to images

Course contents

- Fourier analysis
- Sampling theory
- 3D-reconstruction
- Radon transform
- Central section theorem
- Image restoration
- Transfer theory
- Correlation
- Convolution
- Multivariate statistics

Course literature

Bracewell, Ronald N., Fourier Analysis and Imaging, Academic/Plenum Publishers 2004, ISBN-10: 0306481871
Koeck, Philip J. B., Introduction to Biophysical Electron Microscopy (compendium)

Examination

- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 6.0 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

Passed written exam (TEN1; 6 cr.) grading A-F.
Passed lab works (LAB1; 1.5 cr.) grading 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.