



# SK2740 Introduction to Scanning Probe Microscopy 6.0 credits

Introduktion till svepprob-mikroskopi

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

## Establishment

The course syllabus is valid from Spring 2022 according to the school principal's decision:  
S-2022-0529 Decision date: 2022-02-24

## Grading scale

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

## Education cycle

Second cycle

## Main field of study

Engineering Physics

## Specific prerequisites

A degree in mathematics, physics, chemistry or material science at the bachelor level.

English B / English 6

# Language of instruction

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

## Intended learning outcomes

The objective is to offer students an opportunity to learn the theory of operation of scanning probe microscopes, and to gain hands-on understanding of scanning probe microscope operation, with particular emphasis on the Atomic Force Microscope (AFM). To teach the fundamental physical principals behind the two basic modes of AFM, as well as to give a survey of the many variations of these two modes used in specialized measurement methods. Armed with this understanding and intuition, students should be able to:

- better interpret the images produced by the AFM and the measurements made by AFM that they encounter in the research literature
- finish with a deeper understanding of AFM and become more knowledgeable users of the instrument.

## Course contents

The course is designed for students from a wide variety of educational backgrounds, from Physics, Chemistry and Biology, who would like to learn about the technical details of how SPM's work, and the possibilities and pitfalls in interpreting the images that SPM's produce. We will look in detail at some of the many different modes of SPM usage, with particular emphasis on Atomic Force Microscopy (AFM) and its many variations.

- SPM overview
- Scanners, Sensors, Feedback and Control
- Cantilevers and Tips, Force Measurements
- Fluctuations, Noise and Fundamental Limits
- Surface Forces, Adhesion and Friction
- AFM Colloidal Probe Technique
- Nonlinear Cantilever Dynamics
- SPM Application in Industry

## Examination

- PRO1 - Project, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 3.0 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.

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

## Other requirements for final grade

Attendance to the lectures and labs. Each of the two labs in the course requires a written report (LAB1, 3 hp, grading scale A-F). Students with sufficient mathematical background will do a computer simulation project, others not comfortable with this simulation project will do a literature project. These projects will require a written report (PRO1, 3 hp, grading scale A-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.