Faculty of Science

FYST42, Physics: Scanning Probe Microscopy, 7.5 credits

Fysik: Svepspetsmikroskopi, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2009-10-07 and was last revised on 2009-10-07. The revised syllabus applies from 2009-10-07, spring semester 2010.

General Information

The course is an elective course for second-cycle studies for a Bachelor's or Master's degree in the Natural Sciences.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

Knowledge and understanding

After completion of the course the student shall be able to:

- describe and explain the fundamental physical principles which are made use of in the imaging with scanning tunnelling microscopy (STM) and atomic force microscopy (AFM),
- describe and explain how measurement data are interpreted,
- describe other microscopy techniques and sensor applications which have been developed based on STM and AFM,
- describe the possibilities and limitations in the use of scanning probe microscopy (SPM),
- evaluate and choose a suitable SPM method to address a specific question.

Competence and skills

After completion of the course the student shall be able to:

- use AFM for imaging purposes,
- write well-structured project reports which summarise, explain, and analyse experimental and/or theoretical works,
- present own results in an oral presentation,
- independently search for information beyond what is provided in the course literature,
- integrate the knowledge acquired in the course into scientific discussions.

Course content

- Introduction to scanning probe microscopy
- Instrumentation
- Data collection/control electronics, concepts for vibration isolation, and instrumentation for positioning
- STM: principle and applications, imaging methods, tunnelling spectroscopy, and tip and sample preparation
- AFM: principle and applications, imaging methods, force curves, and tip and sample preparation
- Other STM techniques: principles and applications
- Application of SPM in physics, chemistry, biology, and nanotechnology
- Data treatment and interpretation of data
- Sensors based on SPM methods

Course design

The teaching consists of lectures, laboratory sessions, seminars, group exercises, and project works. The participation in all parts of the course is mandatory.

Assessment

Written and oral examination in the form of a written project report and an oral presentation at the end of the course. Students who do not pass the regular exam are offered a new possibility shortly after the regular exam.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the course an approved hand-in problem, approved laboratory reports, and approved project report as well as participation in all mandatory parts of the course are required. The final grade is decided by assessment of the different aspects of examination.

Entry requirements

For admission to the course 90 credits in the natural sciences are required. FYSC01, Physics 3, Quantum Physics, 30 credits, or the equivalent is required as well as English B

Subcourses in FYST42, Physics: Scanning Probe Microscopy

Applies from H09

0901 Scanning Probe Microscopy, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction