



DEPARTMENT OF PHYSICS

FYM340 Advanced materials imaging and microanalysis, 7.5 credits

Avancerad avbildning och mikroanalys, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2020-05-04 and was last revised on 2023-05-08 to be valid from 2024-01-15, spring semester of 2024.

Field of education: Science 100%

Department: Department of Physics

Position in the educational system

The course is elective within the master program in physics.

The course can be part of the following programmes: 1) Complex Adaptive Systems, Master's Programme (N2CAS) and 2) Physics, Master's Programme (N2PHY)

Main field of studies

Physics

Specialization

A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

A Bachelor's degree in physics or equivalent, including solid state physics.

Applicants must prove their knowledge of English: English 6/English B from Swedish Upper Secondary School or the equivalent level of an internationally recognized test, for example TOEFL, IELTS.

Learning outcomes

The purpose of this course is to provide a basic knowledge of the physics behind modern imaging and microanalytical techniques based on the interaction of a probe of energetic electrons or ions with matter, and to develop an understanding of how different signals

generated in these processes may be interpreted in terms of a material's structure at the atomic, nano and micro scales. The course will also give some practical experience of up-to-date instrumentation utilizing the techniques in imaging and microanalysis that are discussed. The techniques discussed in the course are powerful tools that are widely used in materials research and development in both industry and academia. The course provides a basis for specialised courses in, for example, experimental physics, materials physics and nanoscience.

After completion of this course the student should be able to discuss the physics behind image formation, diffraction and microanalysis based on electron interaction with matter. The student should also be able to discuss critical aspects of modern electron and ion imaging and microanalytical techniques in terms of obtained information, resolution, accuracy and sensitivity. The student will get both theoretical and practical experience of the scanning and transmission electron microscopes (SEM, TEM), focused ion beam instruments (FIB) and microanalytical techniques such as X-ray energy dispersive spectrometry (XEDS) and electron energy loss spectroscopy (EELS).

Course content

- Electron interaction with matter.
- Ion interaction with matter.
- Image formation using lenses.
- Electron diffraction.
- X-ray energy dispersive spectrometry (XEDS)
- Electron energy loss spectroscopy (EELS).
- Resolution.
- Scanning electron microscopy (SEM).
- Transmission electron microscopy (TEM).
- Focused ion beam (FIB) instruments.

Form of teaching

The course comprises lectures, tutorials and compulsory laboratory sessions.

Language of instruction: English

Assessment

Written examination. Compulsory laboratory sessions.

A student who has taken two exams in a course or part of a course without obtaining a pass grade is entitled to the nomination of another examiner. The student needs to contact the department for a new examiner, preferably in writing, and this should be approved by the department unless there are special reasons to the contrary (Chapter 6 Section 22 of the Higher Education Ordinance).

If a student has received a recommendation from the University of Gothenburg for special educational support, where it is compatible with the learning outcomes of the course and provided that no unreasonable resources are required, the examiner may decide to allow the student to sit an adjusted exam or alternative form of assessment.

In the event that a course has ceased or undergone major changes, students are to be guaranteed at least three examination sessions (including the ordinary examination session) over a period of at least one year, but no more than two years, after the course has ceased/been changed. The same applies to placements and professional placements (VFU), although this is restricted to just one additional examination session.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

Course evaluation

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.