# Introductory Course in Scanning Electron Microscopy, 4.5 credits

Introduktionskurs i svepelektronmikroskopi, 4.5 hp

Third-cycle education course

6FIFM88

Department of Physics, Chemistry and Biology

Valid from: First half-year 2024

**Approved by** **Approved**

**Registration number**

## Entry requirements

Entry requirement for studies on third-cycle education courses

- second-cycle degree,
- 240 credits in required courses, including at least 60 second-cycle credits, or acquisition of equivalent knowledge in some other manner

## Learning outcomes

The aim of this course is introducing the basic concepts, instrumentation, and application of SEM in practice. By the end of the course the students will be able to operate SEM with a deeper understanding of how the microscope works, how to choose imaging conditions for various types of samples in order to get the best possible result and how to interpret the data. Theoretical introduction will be followed by practical labs and lead to obtaining license to use SEM Sigma and SEM Gemini.

## Contents

**Basics of SEM imaging**: lens aberrations, object resolution, image quality, interactions between electrons and materials, signal detection, contrast formation and interpretation, material and topography contrasts.
**Operating SEM**: working distance, aperture size, condenser lens strength and aberrations, interaction volume.
**Advanced methods**: imaging of charging samples, environmental SEM, imaging in transmission mode.
**Chemical analysis**: elemental mapping with Energy Dispersed X-ray (EDX) spectroscopy.
**Crystal structure analysis**: introduction to Electron Back-Scattered Diffraction (EBSD), crystallographic orientation and phase mapping.
**Practical skills**: introduction to basic alignments, detectors and learning how to choose and set experimental conditions. Imaging using back-scattered electrons, imaging of charged samples with Variable Pressure mode, elemental mapping with EDX spectroscopy, correlative microscopy, imaging of thin sample in transmission mode, introduction to EBSD and electron channeling imaging. >

## Educational methods

The course will consist of 5 2-hr lectures, 3 6-hr labs and home assignments.

## Examination

Completing home assignments, participating in practical labs, and passing a written exam are required. Students who fail are offered one re-examination occasion in close connection to the course.

## Grading

Two-grade scale

## Course literature

All necessary study material will be handed out during the lectures or be made available electronically.