

**Transmission Electron Microscopy (TEM), 6.0 credits**

Transmissionselektronmikroskopi (TEM), 6.0 hp

Third-cycle education course

6FIFM76

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

## Specific information

Course period: February-April, provided sufficient interest.

## Learning outcomes

After successful completion of the course, participants will have proficiency to:

- understand and explain the theoretical basis of TEM techniques and methods.
- choose and implement the appropriate TEM analysis method for a given sample with regards to the type of analysis needed.
- critically analyse and relate TEM data to material research questions.
- demonstrate the practical skills in operation of TEM equipment in efficient way.

## Contents

TEM is a powerful microscopy technique enabling material investigations on the atomic level. The aim of this course is introducing the basic concepts, instrumentation and application of TEM analysis to the students. The gained knowledge will enable students to understand TEM concepts, operational principles, perform analyzes and result interpretation. The lectures will focus on fundamental theory of TEM and cover the topics necessary to understand the prime microscopy techniques. Labs are designed to provide the basic knowledge of TEM operation and to solidify the concepts presented in the lectures.

The course will cover the following topics:

- Basic TEM concepts and TEM sample requirements
- TEM imaging techniques
- Electron diffraction
- Scanning TEM (STEM)
- Spectroscopy (EDX, EELS and EFTEM)
- Latest advancements in TEM

## Educational methods

The course consists of lectures (5 lectures x 2h), seminar (1 x 2h), hands-on laboratory exercises (5 labs x 7h), TEM software demo (1 x 3h) self-study of scientific articles, and self-practice in the lab.

## **Examination**

Compulsory and active participation in all course activities, demonstration of practical skills in the lab and written exam.

The participants who pass the course will be:

- awarded with 6 ETC.
- given the license to book Galadriel TEM system

Students who fail are offered one re-examination occasion in close connection to the course. After that participation in a coming course examination is offered. The re-examination should be equally comprehensive as the ordinary examination.

## **Grading**

Two-grade scale

## **Course literature**

D.B. Williams and C.B. Carter "Transmission Electron Microscopy", lecture notes, research articles and other hand-outs.

## **General information**

The course is planned and carried out according to what is stated in this syllabus. Course evaluation, analysis and suggestions for improvement should be fed back to the Research and PhD studies Committee (FUN) by the course coordinator.

If the course is withdrawn or is subject to major changes, examination according to this syllabus is normally offered at three occasions within/in close connection to the two following semesters.