



LUND
UNIVERSITY

Faculty of Science

MAXM07, Introduction to Accelerators and Free Electron Lasers, 7.5 credits

*Introduktion till acceleratorer och frielektronlaser, 7,5
högskolepoäng*

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2008-11-14 and was last revised on 2008-11-14. The revised syllabus applies from 2008-11-14, spring semester 2009.

General Information

The course is included in the Master of Science programme in Synchrotron Radiation Based Science at the Faculty of Science. It is a compulsory second-cycle component of a degree of Master of Science in Synchrotron Radiation Based Science.

Language of instruction: English

Main field of studies

Synchrotron Radiation Based Science

Depth of study relative to the degree requirements

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

Learning outcomes

The objective is that the students, on completion of the course, shall have acquired the following knowledge and skills.

- Knowledge of different accelerator types and how they function
- Understanding of and ability to apply basic beam dynamics for accelerators
- Overview knowledge of their applications in research, medicine and industry
- Basic understanding of accelerators for synchrotron radiation
- Basic understanding of the free electron laser (FEL) process and different types of
- Knowledge of and ability to use the basic physical methods of relevance to accelerators and FELs
- Knowledge of and ability to perform simple simulations of accelerators
- Knowledge of important subsystems of accelerators (such as vacuum and HF technology)

- Knowledge of the structure, operation and safety of an accelerator laboratory

Course content

The course comprises 7.5 credits and consists of one component.

The course deals with different accelerators (cyclotrons, microtrons, linear accelerators and synchrotrons), and their function and structure. It situates the different types in context and introduces their different applications in research, medicine and industry. The different components of an accelerator are analysed (different types of electron guns, problems and solutions, sources of particles), and the theory of magnets and how they are used in beam dynamics are described and used to build models of accelerators (dipole, quadrupole and general magnets, particle optics, focusing, matrix formulation, betatron oscillations, beta functions, emittance, etc.). Accelerators for synchrotron radiation (especially synchrotrons) are described in details. The free electron laser (FEL) process and different types of FEL (SASE, cavity-FEL, harmonic generation, high-gain harmonic generation, seeding) are described. The course introduces the basic components of a major accelerator laboratory and stresses awareness of radiation safety and risks in particular.

Course design

The teaching consists of lectures, study visits, demonstrations at the MAX IV Laboratory, seminars, assignments, laboratory experiments and group exercises. Participation in group exercises, laboratory experiments, study visits, demonstrations and associated teaching, and assignments is compulsory.

Assessment

The assessment is based on written assignments. Students who fail an assessment will be offered another opportunity for assessment soon thereafter.

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.

For a grade of Pass on the whole course, the student must have passed the exam, assignments and laboratory reports, and participated in all compulsory components.

The final grade is determined by an aggregate of the results on all assessed components.

Entry requirements

To be admitted to the course, students must meet the general requirements for admission to Swedish higher education, have English B from Swedish upper secondary school and 90 credits in science or engineering.

Further information

The course may not be included in a degree together with course MAXC11/EXTF90 Photon and Neutron Production for Science, 7.5 credits.

Subcourses in MAXM07, Introduction to Accelerators and Free Electron Lasers

Applies from H09

0801 Introduction to Accelerators and Free Electron Lasers, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction