ED2220 Experimental Fusion Plasma Physics 6.0 credits

Experimentell fusionsplasmafysik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for ED2220 valid from Autumn 2010

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering,Engineering Physics,Physics

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The purpose of this course is to make the student familiar with basic experimental and diagnostic techniques used in magnetic confinement fusion plasma physics research. The student will learn about techniques for generation of high temperature toroidal fusion plasmas and be able to understand the physics underlying the common fusion plasma diagnostics methods. Experimental techniques for generation of fusion plasmas will be exemplified by studying the systems at the EXTRAP T2R reversed field pinch device at KTH. In addition, the student will gain practical experience of using some diagnostics that are available at EXTRAP T2R and analyzing real measurement data. Physics concepts underlying the plasma diagnostic methods will be introduced and discussed, using a systematic approach from first principles. A number of plasma diagnostic applications will be introduced in more detail.

After passing the course, the student should be able to

- describe experimental techniques for generation of high temperature toroidal fusion plasmas,
- formulate the underlying physics principles for common plasma diagnostic methods,
- estimate measurement errors in plasma diagnostic data,
- explain the technical features of some commonly used basic plasma diagnostic applications,
- demonstrate the practical usage of some selected plasma diagnostics that are available at EXTRAP T2R,
- write simple computer codes for acquiring, analyzing and visualizing data from some selected plasma diagnostics using commercial software packages (IDL, MATLAB),
- perform certain common data analysis tasks, such as Fourier transform and signal filtering using available software routines,
- present analyzed data in graphic form in short reports, that includes descriptions of the diagnostic setup and the data analysis methods used.

Course contents

Experimental techniques for generation of high temperature toroidal fusion plasmas, including vacuum technology, magnets, energy storage, plasma control methods and data acquisition. Underlying principles for common plasma diagnostic methods such as magnetic measurements, measurements of plasma particle flux, measurements of plasma refractive index, electromagnetic emission by free electrons, electromagnetic emission from bound electrons, scattering of electromagnetic waves, measurements of ion processes. Practical usage of some basic plasma diagnostic applications. The selection of diagnostic applications is based on the systems available at EXTRAP T2R, and includes magnetic diagnostics, interferometer, Thomson scattering, spectrometers, bolometers, SXR camera, and electric probes.

Specific prerequisites

120 hp in electrical engineering or technical physics including documented proficiency in English B or equivalent.

Course literature

Experimental Fusion Plasma Physics, Per Brunsell, KTH, 2007

Examination

- INL1 - Assignment, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Individual home assignments will be given that exemplify the theory. Group assignments will be given that require the students to use diagnostics and analyze data to obtain specific information, e. g. electron temperature and density, radial radiation profiles, or plasma fluctuation characteristics. Course credits will be given for completed individual and group assignments.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.