



FED3305 Magnetohydrodynamics, Advanced Course 6.0 credits

Magnetohydrodynamik, avancerad kurs

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 FED3305 valid from Autumn 2011

Grading scale

Education cycle

Third cycle

Specific prerequisites

Language of instruction

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

Intended learning outcomes

When completing the course, the student should be able to:

- describe the MHD spectrum and characterise the MHD waves in a cylinder and the basic modifications in a toroidal geometry

- describe the basic structure of magnetic field lines in a three dimensional geometry and magnetic confinement.
- describe the basic MHD instabilities and how they limit magnetic confinement
- describe how resistivity modifies the MHD theory and the implication on stability.
- describe the non-linear evolution of common MHD instabilities in plasmas.

Course contents

Individually adapted from the following areas:

The MHD spectrum in a cylinder; interpretation of the continua, global Alfvén and slow waves, condition for existence of discrete spectrum with cluster points (Suydam criterion and criterion for existence of global Alfvén eigenmodes). MHD stability of a cylindrical plasma. Structure of 3D magnetic fields; magnetic island and regions with ergodic field lines. Toroidal equilibria; the Grad-Shafranov equation. MHD stability of toroidal plasma; Mercier criterion and ballooning modes. Tearing modes. Alfvén eigenmodes in toroidal plasmas. Non-linear MHD; sawtooth, fishbones, disruptions.

In agreement with the examiner topics outside these areas can be included.

Disposition

Seminars or discussion meetings.

Course literature

Lecture notes and articles adapted to individual needs.

R.B. White Theory of Toroidal Confined Plasmas 2001 imperial College Press

A. H. Boozer Physics of Magnetically Confined Plasmas, Reviews of Modern Physics, Vol. 76, Oct 2004 p.1071-1140.

J. Wesson, Tokamaks, Clarendon Press, Oxford, 1997.

R. D Hazeltine and J. D. Meiss, Plasma Confinement, Dover Publication, INC. Mineola, New York 2003.

Examination

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

Written exam and final oral exam.

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.