FED3330 Transport Theory 8.0 credits

Transportteori

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 FED3330 valid from Autumn 2011

Grading scale

Education cycle

Third cycle

Specific prerequisites

Master in Nuclear Fusion Research or Equivalent

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

- Provide the details of the derivation of Pfirch – Schlueter current and flows.
- Describe and explain the origin of plasma rotation in tokamaks and RFP.
- Demonstrate the basic properties of suppression of turbulence by electric field shear
- Give the derivation of the current drive and neoclassical flows.
- Assess profile consistency and ergodization by external coils
- Derive the neoclassical poloidal and toroidal rotation
- Apply the variational principle to the derivation of canonical profiles
- Demonstrate understanding of the emergence of transport barriers and improved confinement
- Discuss major issues of edge physics in ITER such as blobs and divertor operation

Course contents

Braginski equations for cylindrical geometry. Neutral particle transport. The impact of the toroidicity on the transport in tokamaks. Rotation of plasma in tokamaks. L & H regimes of the tokamak confinement. Electric field profiles in tokamaks. Edge turbulence. Inverse cascade and zonal flows. Biasing resulting in the improved confinement regimes. Electrostatic drift waves and the mixing-length estimate. The reason for the emergence of stochasticity in fusion devices. Anomalous diffusion. Rechester-Rosenbluth diffusion. The amelioration of ELM ´s by resonance magnetic perturbations.

Disposition

Discussion meetings. Studies in depth of topical monographies and review articles.

Course literature

Helander & Sigmar Neoclassical Transport
Rozhansky & Tendler Plasma Rotation in Tokamaks Reviews of Plasma Physics V. 19 ed. B.B. Kadomtsev, New York & London p.147.

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

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.