FED3320 Fusionsforskning 8,0 hp

Fusion Research

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

Fastställande

Kursplan för FED3320 gäller från och med VT12

Betygsskala

Utbildningsnivå

Forskarnivå

Särskild behörighet

Courses FED3210 and FED3230 (or corresponding) are prerequisites.

Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

Lärandemål

When completing the course, the student should be able to

- Give an account of fusion reactions and conditions for fusion energy production
- Explain different experimental approaches to fusion

- Discuss reactor power balance and thermal stability
- Derive and discuss MHD tokamak instabilities from the Energy principle
- Give an account of current stability issues for tokamaks
- Assess confinement and experimental confinement scalings
- Discuss limits of operations for magnetic fusion devices
- Discuss the value of non-tokamak aproaches to magnetic fusion
- Give an account of important experiments around the world
- Explain the basic principles of inertial fusion and the status of research
- Give an account of the safety and environmental aspects of fusion
- Discuss the motivation for fusion energy research in a global perspective

Kursinnehåll

Fusion reactions. Fusion in nature. Future energy demands. Energy alternatives. Fusion history. Different approaches to fusion. The Lawson criterion. Breakeven, ignition. Quality parameters of the fusion plasma. Fusion reactor power balance and thermal stability. Heating of fusion plasmas. The Energy principle applied to different configurations. Tokamak stability; MHD and non-MHD modes. Resistive instabilities. Resistive wall modes and feedback control. Density and beta limits. Edge localized mode (ELM), multi-faceted asymmetric radiation from the edge (MARFE). Fishbones. Disruptions. Confinement modes and energy confinement scaling laws. Reversed shear scenarios. Characteristics of different magnetic confinement schemes. Spherical and compact tokamaks. RFP and stellarator stability. Reactor design and reactor studies. ITER design. Magnetized target fusion. Inertial fusion; direct and indirect drive, fast ignition, the large experiments NIF and LMJ. Safety and environmental aspects of fusion. Fusion research at KTH and at different experiments in the world.

Kursupplägg

Discussion meetings.

Kurslitteratur

Parts of the following literature, or similar:

- J. Scheffel and P. Brunsell, Fusion Physics, KTH 2007.
- J. P. Freidberg, Plasma Physics and Fusion Energy,
- Cambridge University Press 2007.
- J. Wesson, Tokamaks, Oxford University Press 2004.
- W. M. Stacey, Fusion Plasma Physics, Wiley 2005.
- A. A. Harms et.al., Principles of Fusion Energy, World Scientific, 2000.
- S. Pfalzner, An Introduction to Inertial Confinement Fusion, Taylor and Francis 2006.

Examination

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

Övriga krav för slutbetyg

Final oral exam.

Etiskt förhållningssätt

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.