UNIVERSITY OF GOTHENBURG

PHYSICS

ASM440 Plasma Physics with Applications, 7.5 higher education credits

Plasma Physics with Applications, 7,5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2008-09-16 and was last revised on 2017-05-22 to be valid from 2017-05-22, spring semester of 2017.

Field of education: Science 100%
Department: Physics

Position in the educational system

The course ASM440 is a programme course in the Physics Master Programme, as well as a single subject course at the University of Gothenburg.

The course can be part of the following programmes: 1) Complex Adaptive Systems, Master's Programme (N2CAS), 2) Physics of Materials and Biological Systems, Master's Programme (N2PMB) and 3) Physics, Master's Programme (N2PHY)

Main field of studies	*Specialization*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

To be eligible for the course ASM440 the student needs knowledge in mathematics and physics equivalent to a Bachelor degree. The student should also be familiar with electromagnetic field theory.

Applicants must prove knowledge of English: TOEFL test result of at least 600 points (computerized 250 points, on Internet 100 points) or IELTS test result of at least 6.0, including at least 6.5 for the Writing. This requirement does not apply to students with a Bachelor degree from an English speaking university, or to students having passed

English level B at Swedish/Nordic Upper Secondary School.

Learning outcomes

Students who have followed the course ASM440 Plasma physics with applications will:

- understand basic properties of plasmas and their interaction with electromagnetic fields.
- have acquired knowledge of some of the applications where plasmas play an important role. These applications cover a broad range from astrophysics and space physics to fusion energy production and technical applications.

Course content

The course will give insight into how plasmas are created, where they appear and will try to develop a physical understanding of the characteristic properties of plasmas. An important part of the course is to illustrate plasma physics concepts and phenomena by considering applications ranging from fusion energy generation and microwave techniques to space physics and astrophysics.

Basic theory: Conditions for the existence of plasmas, plasma particle motion in electric and magnetic fields, simplest model equations for description of plasma phenomena (cold two-fluid description), waves in plasmas (electron plasma oscillations, waves in magnetized plasmas, resonances and cut-offs), instabilities in plasmas, magnetohydrodynamics, qualitative introduction to temperature effects in plasmas, simple kinetic plasma theory, derivation of a fluid description of hot plasmas, collisions, diffusion and resistivity.

Main application: The main application of plasma physics in this course is in nuclear fusion research. A brief discussion will be made on the theory for stability and transport in fusion devices including a description of the main fusion concepts. The theory will include magnetohydrodynamics (MHD) governing global stability and drift waves giving rise to transport. Criteria for stability and scaling laws for transport will be discussed and applied to the design of a fusion reactor. Safety and environmental aspects will also be discussed.

Other applications: Wave propagation in the ionosphere, space and the interstellar medium. microwave induced breakdown in waveguides, resonators and filters, microwave heating of plasmas for fusion energy generation.

Form of teaching
The course will be presented in the form of lectures where basic theory and instructive applications are discussed. An important part of the course will be home work in the form of exercises, which will be given approximately 1/week.

Language of instruction: English

Assessment
The examination is in the form of a written examination and completed hand-in exercises.

A student who has failed a test twice has the right to change examiner, unless weighty argument can be adduced. The application shall be sent to the board of the department and has to be in writing.

Grades
The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
ECTS grades are also given on this course.

Course evaluation
The results of the evaluation will be communicated to the students and will function as a guide for the development of the course.

Additional information
The course is given jointly with Chalmers University of Technology. The Chalmers code for the course is RRY085.