Department of Astronomy

Stockholm University

Syllabus

for course at advanced level

Astrophysical magnetohydrodynamics
Astrofysikalisk magnetohydrodynamik

7.5 Higher Education Credits
7.5 ECTS credits

Course code:	AS7019
Valid from:	Spring 2012
Date of approval:	2011-11-21
Department	Department of Astronomy
Main field:	Astronomy
Specialisation:	A1F - Second cycle, has second-cycle course/s as entry requirements

Decision

This syllabus has been approved by the Board of the faculty of Science at Stockholm University 2011-11-21.

Prerequisites and special admittance requirements

Admission to the course requires knowledge equivalent to a bachelor's degree in astronomy, as well as the course Astrophysical Gasdynamics, 7.5 hp (AS7002). English B or equivalent.

Course structure

Examination code	Name	Higher Education Credits
HELA	Astrofysical magnetohydrodynamics	7.5

Course content

The course explores the connection between the Sun and the Earth, their radial structure and the equations used to describe this. Atmospheric waves (p and g modes) and the numerical methods which are used to describe these. Helioseismology. Abel's integral equation, Supersonic flows and energy conservation, Magnetic fields, magnetic support and mass ejections from the corona. The physics of thin accretion disks: time-independent and time-dependent Alfvén wave: slow and fast, as well as the magneto-rotational instability. Laminar and turbulent dynamos. Dimensional analysis and shock waves. Convection, turbulence and the concept of "mixing length". Magnetic reconnection.

Learning outcomes

Upon completion of the course, students are expected to be able to
- describe the magnetohydrodynamic equations.
- show good understanding for waves and instabilities.
- show good understanding for shocks, the solar wind and accretion.
- describe the fundamentals of turbulence convection.
- describe dynamo theory.
- show understanding for the numerical methods which are being used for MHD and turbulence.

Education

Instruction consists of lectures, exercises and practical laboratory work. Participation in laboratory work and any associated integrated instruction is compulsory. In the event of special circumstances, the examiner may, after consultation with the teacher concerned, grant a student exemption from the obligation to participate in certain compulsory instruction.

Forms of examination

a. The course is examined as follow: Knowledge assessment takes the form of a written exam, hand-in exercises and a written report on the laboratory work. If the instruction is in English, the examination may also be conducted in English.
b. Grades will be set according to a seven-point scale related to the learning objectives of the course:
A = Excellent
B = Very good
C = Good
D = Satisfactory
E = Adequate
Fx = Fail, some additional work required
F = Fail, much additional work required
c. The grading criteria will be distributed at the beginning of the course.
d. In order to pass the course, a minimum grade of E is required together with participation in all compulsory instruction.
e. Students who receive a failing grade on a regular examination are allowed to retake the examination as long as the course is provided. The number of examination opportunities is not limited. Other mandatory course elements are equated with examinations. As student who has received a passing grade on an examination may not retake the examination to attain a higher grade. A student who has failed the same examination twice is entitled to have another examiner appointed, unless there are special reasons to the contrary. Such requests should be made to the department board.
The course includes at least two examinations opportunities per year when the course is given. At least one examination opportunity will be offered during a year when the course is not given.
f. Students awarded the grade Fx are given the opportunity to improve their grade to E. The examiner decides the supplementary assignments to be performed and the pass mark criteria. The supplementary assignments will take place before the next examination session.

Interim

Students may request that the examination be conducted in accordance with this course syllabus even after it has ceased to be valid. However, this may not take place more than three times over a two year period after the course instruction has ended. Requests must be made to the departmental board. The provision also applies in the case of revisions to the course syllabus (and revisions of the course literature).

Required reading

The course literature is decided by the department board and published on the Department of Astronomy's website at least two months before the start of the course.