Faculty of Science

ASTC12, Astronomy: Astrophysics of Stars, 7.5 credits

Astronomi: Stjärnornas astrofysik, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-12-03. The syllabus comes into effect 2024-12-03 and is valid from the autumn semester 2025.

General information

The course is an elective course for first-cycle studies for a Degree of Bachelor of Science (180 credits) in astrophysics.

Language of instruction: English
The course is given in English.

Main field of study	*Specialisation*
Physics	G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Learning outcomes

Upon completion of the course, the student should have acquired an overview of modern stellar astrophysics. They should have gained practical experience of making and analysing astrophysical observations and using them to understand stellar systems. The student should be able to quantitatively apply the theory of stellar structure to calculate physical properties of stars. They should have a knowledge, at a general level, of the ways in which stars give birth to high-energy astrophysical systems and how they are observed.

Knowledge and understanding

On completion of the course, the student shall be able to:

- Describe the different ways in which stars can be observed and what can be learnt from these observations

- Explain the connection between observable properties of stars and the physical processes that take place inside them
- Account for high-energy astrophysical phenomena and their physical origins.

Competence and skills

On completion of the course, the student shall be able to:

- Plan, execute and interpret visual observations of stars and stellar systems
- Construct a Hertzsprung–Russell diagram and analyse it to measure stellar properties
- Apply the theory of binary star orbits including Kepler's laws to observations of binary star systems.

Judgement and approach

On completion of the course, the student shall be able to:

- Critically review a planned astronomical observation and its suitability for achieving stated scientific goals.

Course content

The course gives an introduction to observational and theoretical aspects of the astrophysics of stars and transient phenomena of stellar origin and treats:

- Observations of stars: Coordinates and telescopes; photometry, the magnitude system and extinction; spectroscopy and stellar classification.
- Theory of single stars: Physical processes inside stars; evolution of stars; white dwarfs, neutron stars and black holes.
- Binary stars: Orbits and Kepler's laws; accretion, novae and X-ray binaries.
- High-energy astrophysics: observing high-energy radiation; supernovae, neutron stars and pulsars; gravitational waves and compact binaries.

Course design

The teaching consists of lectures, observational laboratory sessions, group exercises conducted through problem-based learning, and individual exercise sets. Participation in laboratory sessions, problem-based learning and associated teaching elements is compulsory.

Assessment

The examination consists of reports from laboratory and problem-based learning exercises, and a written examination at the end of the course.

Students who do not pass the regular assessment will be offered another opportunity for assessment soon thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
The grading scale for the reports from the laboratory sessions and problem-based learning exercises is Fail, Pass. The grading scale for the final written examination is Fail, Pass, Pass with Distinction. To pass the entire course it is necessary to pass the examination and all of the written reports from the laboratory sessions and problem-based learning exercises.

The final grade for the course is determined by the grade for the written examination. The pass mark is 50% and the mark for pass with distinction is 80%.

Entry requirements

For admission to the course 105 credits in physics or/and mathematics studies is required, and proficiency in English equivalent to English 6/B from Swedish upper secondary school.

Further information

The course replaces ASTB01, Introduction to Astrophysics, 7.5 credits and cannot count towards a degree together with this course, or together with AST201 Astronomy and Astrophysics, 10 credits, AST202 Astronomy: Introduction to Astronomy, 5 credits, AST203 Astronomy: Basic Astrophysics, 5 credits, ASTA11 Astronomy: Astronomy and Astrophysics, 15 credits, or ASTA01 Astronomy: Introduction to Astronomy, 7.5 credits.

The course is offered at the department of Physics, Lund University.