



Faculty of Science

ASTC11, Astronomy: Astrobiology - Conditions and Possibilities for Life in the Universe, 7.5 credits

Astronomi: Astrobiologi - förutsättningar och möjligheter för liv i universum, 7,5 högskolepoäng
First Cycle / Grundnivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2023-12-11. The syllabus comes into effect 2023-12-11 and is valid from the autumn semester 2024.

General information

The course is an elective course for first-cycle studies for a Degree of Master of Science (120 credits) in astrophysics. The course can also be taken as a stand alone course or as part of a bachelor or master program in science.

Language of instruction: 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 skills to apply a perspective from astronomy and geosciences, in describing methods for mapping of environments within, and outside our solar system, where there might exist preconditions for the existence of life as well as to apply a perspective from biology, in describing how life has developed on Earth, and in studying its limits, e.g., the most extreme environments that terrestrial life can endure.

Knowledge and understanding

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

- describe the earliest traces of life on Earth, theories of the origin of life and terrestrial life under extreme conditions
- describe the evolution of other planets and of their atmospheres
- describe the evolutionary history and properties of the planet Mars including climate changes, seasonal variations and their causes, as well as differences with the Earth
- describe the importance of impacts of meteorites and asteroids, their biological effects concerning the extinction or modification of species as well as possible transfer of microorganisms between planets in the solar system
- describe planets around other stars (exoplanets) and current experiments and methods to find and study these
- describe mechanisms for global climate changes and the Earth's future billions of years from now
- describe the search for extraterrestrial intelligence, interstellar communication and the feasibility of interstellar spaceflight
- discuss historical perspectives: how thoughts about extraterrestrial life have shifted throughout history.

Competence and skills

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

- apply mathematical analyses of typical problems arising in astrophysics and exoplanet studies
- carry out literature studies within the research topic as well as oral and computer-based presentation of problems and data analysis

Judgement and approach

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

- reflect on the field of astrobiology as a distinctly multidisciplinary subject
- critically discuss current observational data and its implications for the possibilities of extra-terrestrial life as well as possible philosophical and other consequences of the discovery of extraterrestrial life and/or of extraterrestrial intelligence.

Course content

The course contains:

- Description of those planets and those among their moons in the solar system that can be envisioned to have (or have had, or will have) physical and/or chemical preconditions to develop life.
- The development of the earliest lifeforms on Earth, and extreme environments for present-day life on the bottom of the oceans, around hot springs, deep underground, in permafrost, or in radioactive environments.
- Design of space probes, as well as experiments to study biologically relevant environments on other planets.

- Analysis of extraterrestrial material in the laboratory, and risks for spreading organisms between different planets.
- Current and planned instruments and methods to find and to study planets around other stars.
- Development over geological ages of different planets together with their host star and the development of their atmospheres and climates.
- The search for intelligent life in the Universe, and possible philosophic and other consequences of a possible discovery thereof.

Course design

The teaching consists of lectures, exercises and computer laboratory sessions. Participation in the computer laboratory sessions is compulsory.

Assessment

The examination consists of laboratory reports and a written exam at the end of the course. Students who do not pass the regular exam are offered a re-exam shortly after the regular exam.

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

To pass the entire course, a passed examination, approved laboratory reports and participation in all compulsory parts are required.

The grading scale for the examination and laboratory reports is Fail, Pass, Pass with Distinction.

The final grade is determined by weighing the results in the different parts of the course weighted with size of the corresponding modules.

Entry requirements

The prerequisites required for admission to the course are: at least 60 credits of approved courses within the faculties of either science, technology and/or medicine. Earlier studies in astronomy or biology are not presumed.

Further information

The course cannot be credited towards a degree together with ASTC01, 7.5 hp, or AST221 Astrobiology 5p.

The course is given by the Department of physics at Lund University.