SYLLABUS

Spacecraft Environment Interactions 7.5 credits R7004R

Rymdfarkosters fysiska omgivning

Course syllabus admitted: Spring 2024 Sp 3 - Present

DECISION DATE
2023-02-15

Luleå University of Technology 971 87 Luleå, Sweden
Phone: +46 (0)920 49 10 00 • Corporate Identity: 202100-2841

LULEÅ TEKNISKA UNIVERSITET

Spacecraft Environment Interactions 7.5 credits R7004R

Rymdfarkosters fysiska omgivning

Second cycle, R7004R

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Rymdteknik	Space Technology

Main field of study

Space Technology

Entry requirements

Knowledge of analysis in one and more dimensions, linear algebra, vector analysis, mechanics, thermodynamics and electromagnetic field theory. (E.g. F0005T - Physics 2, 7.5 credits, F0006T - Physics 3, 7.5 credits and F0007T - Electromagnetic field theory, 7.5 credits, M0048M - Linear Algebra and Calculus, 7.5 credits or M0049M - Linear Algebra and Differential Equations, 7.5 credits, M0055M - Multivariable Calculus, 7.5 credits or equivalent).

Good knowledge in English equivalent to English 6.

Selection

The selection is based on 30-285 credits

Course Aim

The student shall acquire knowledge about the space environment, especially concerning its influence on problems for space-crafts and its instruments, as well as methods to mitigate the induced problems. This is shown by ability to describe the space environment and estimate the complex of problems with vehicles in space.

The student shall be able to describe and analyze the space environment and its influence on the spacecraft with its components. This is shown by performed hand calculations on a mathematical and physical basis. The student shall be able to use specific computer programs as a tool for describing the space environment and analyze and calculate its influence on the spacecraft with its components.

The student shall be aware of the uncertainties and limitations, e.g. as a consequence of the solar activity, that are associated with vehicles in space. The student shall be aware of the possible negative consequences with satellites in space, as e.g. space debris. This is shown by valuation of associated questions.

Contents

The space environment: solar radiation and solar wind, low temperatures, vacuum, atomic oxygen, atmospheric drag, orbital debris and micrometeoroids, plasma, and radiation. Effects on the spacecraft: outgassing, contamination, chemical reactions, atmospheric drag force, erosion, sputtering, glow, particle collisions, spacecraft charging, radiation influence in different wavelength bands, deep dielectric charging, influence on electronic circuits and living tissues.

Specific program SPENVIS is used in the course to calculate the space environment in satellite orbits and its influence on the spacecraft with its components.

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
Lectures, exercise classes and computer laboratory exercise. In the practical, which preferably is done in group of two students, an open problem is treated that are presented in a written rapport in Swedish or English.

In the practical is computer program used that is also used by the space industry. Guest lecture who has worked with astronauts and cosmonauts.

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided.
Written examination and laboratory report. In order to pass the course it is required that all examinations and obligatory tasks are completely satisfactory. The written exam is graded with 5, 4, 3, and Fail(U), while the written laboratory report is graded with Approved (G) and Fail (U). The course is then graded with 5, 4, 3, and Fail (U). Borderline cases for approval of the written exam have the possibility of obtaining bonus points from the written laboratory report.

Unauthorized aids during exams and assessments

If a student, by using unauthorized aids, tries to mislead during an exam or when a study performance is to be assessed, disciplinary measures may be taken. The term “unauthorized aids” refers to aids that the teacher has not previously specified as permissible aids and that may assist in solving the examination task. This means that all aids not specified as permissible are prohibited. The Swedish version has interpretative precedence in the event of a conflict.

Remarks

Since the course is given for both Swedish and international students, students are trained to communicate in international contexts.

Overlap

The course R7004R is equal to RYM006

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0002	Laboratory work	U G#	1.5	Mandatory	A07	
0003	Written exam	G U 3 4 5	6	Mandatory	S22	

Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students

applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Robert Brännström 2023-02-15

Syllabus established

The course plan was accepted by the Dept of Space Science 2007-02-28 and remains valid as from H07.