

SYLLABUS

Propulsion with space applications 7.5 credits R7023R

Framdrivning med rymdapplikationer

Course syllabus admitted: Spring 2024 Sp 3 - Present

**DECISION DATE
2023-02-15**

Propulsion with space applications 7.5 credits R7023R

Framdrivning med rymdapplikationer

Second cycle, R7023R

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

Entry requirements

Fluid-dynamics (e.g. technical mechanics, F0059T, 7.5 credits) , chemistry (e.g. chemical principles, K0016K, 7.5 credits), electromagnetic field theory ((e.g. electromagnetic field theory and electromagnetic systems, F0056T, 7.5 credits), thermodynamics (e.g. physics 1, F0004T, 7.5 credits).

Good knowledge in English equivalent to English 6.

Selection

The selection is based on 30-285 credits

Course Aim

After the course, the students shall be able to:

- Apply the fundamental rocket theory, physical and mathematical tools to design and analyse propulsion systems for launchers and spacecrafts.
- Analyse and solve basic problems in rocket thermochemistry.
- Perform preliminary design of propulsion sub-systems (thrust chambers, nozzles, tanks, etc.) for launchers and spacecrafts considering different propulsion technologies (solid, liquid and hybrid).
- Execute preliminary designs of launchers and spacecrafts.
- Analyse and solve basic problems in electric propulsion.
- Apply the above-described techniques on real-world space vehicle projects, and report on this work both orally and in writing.

Contents

The course covers the essentials of launchers and spacecrafts propulsion technologies, focusing on two main areas: Thermal (chemistry) propulsion and electrical propulsion. The subjects treated in this course comprise performance parameters (thrust, specific impulse, etc.); Nozzle theory and thermodynamic relations; Rocket equation, staging, ideal rocket theory; Solid propellant motor: components, propellants and propellant properties, performance, nozzle, thrust vectoring; Liquid propellant engine: components and subsystems, (mono- and bi-component) propellants, thrust chamber, tanks, pipes, pressure feeding systems, performance, nozzles, thrust vectoring; Cold gas thruster: components and subsystems. Overview of electric propulsion systems: resistojet, ArcJet, magnetoplasmadynamic thruster, pulsed plasma thruster, ion thruster, field-emission thruster, Hall-effect thruster

Realization

Each course occasion's language and form is stated and appear on the course page on Luleå University of Technology's website.

Lectures covering the contents, individual and group assignments, and practical using mathematical and engineering tools for modeling and design.

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 composed by questions involving theory and mathematical problems. A number of hand in assignments along the course and, at the end of the course, a project assignment performed in group with oral presentation.

The final grade given for the course reflects the results obtained in the various components of the course

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.

Course offered by

Department of Computer Science, Electrical and Space Engineering

Modules

Code	Description	Grade scale	Cr	Status	From period	Title
0004	Assignment report	G U 3 4 5	1	Mandatory	A21	
0005	Project work	G U 3 4 5	2	Mandatory	A21	
0006	Written exam	G U 3 4 5	4.5	Mandatory	A21	

Last revised

by Robert Brännström 2023-02-15

Syllabus established

by Jonny Johansson, HUL SRT 2018-02-15