

ENG-510

**Space propulsion**

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Cursus	Sem.	Type
Electrical and Electronical Engineering	MA2, MA4	Opt.
Space technologies minor	E	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Oral
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Lecture	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

The main objective of the course is to provide an overview of space propulsion systems. The course will also describe the basic design principles of propulsion systems.

**Content**

**Introduction in Spacecrafts** - Short highlights of spacecraft design including overview on subsystems.

**Introduction in Propulsion Systems** - Brief overview on all space propulsion systems

**Design guidelines for Propulsion Systems** - Main design principles (basic performance equations) for propulsion systems considering different mission objectives

**Propulsion System Architecture** - Description of propulsion subassemblies needed for the different propulsion systems like pressurization system

**Propulsion System Components** - Description of basic equipment needed for the different propulsion systems like pressure regulator

**Performance Analysis of Propulsion Systems** - Basic tools for performance of propulsion system analysis

**Subsystem Aspects on Propulsion Systems** - Coherence of propulsion system design with other spacecraft subsystems like structure, thermal subsystem, electrical system

**System Aspects on Propulsion Systems** - Coherence of propulsion system with system design like launcher stages or spacecraft architecture

**Life Cycle of Propulsion Systems** - Complete overview of propulsion system life cycle

**Future Aspects of Propulsion Systems** - Introduction in future evolution of propulsion systems as well as overview of current investigations on new propulsion systems

**Keywords**

Space Propulsion, Thermal Propulsion, Chemical Propulsion, Electric Propulsion, Nuclear Propulsion, Other Propulsion Systems (e.g. tether, solar wind)

**Learning Prerequisites****Required courses**

None

**Recommended courses**

Space mission design and operations  
Spacecraft design and system engineering

**Learning Outcomes**

By the end of the course, the student must be able to:

- Analyze propulsion system requirements
- Plan a project in phases
- Coordinate tasks between different engineering disciplines
- Translate system requirements into subsystem requirements
- Justify propulsion system selection

### Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Communicate effectively, being understood, including across different languages and cultures.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.
- Set objectives and design an action plan to reach those objectives.
- Respect relevant legal guidelines and ethical codes for the profession.
- Demonstrate a capacity for creativity.
- Access and evaluate appropriate sources of information.
- Make an oral presentation.

### Teaching methods

Lecture every second week in English supported by excersises and project activity.

### Expected student activities

Active participation in the course

Active participation in the exercise sessions

Active participation in the projet group

### Assessment methods

Oral examination and excersise + project work evaluation.

### Supervision

Office hours	Yes
Assistants	No
Forum	No
Others	Support by mail and / or telephone + video calls is ensured.

### Resources

#### Virtual desktop infrastructure (VDI)

No

### Bibliography

Space Propulsion Analysis and Design (Humble, Henry & Larson, Space Technology Series)

Rocket and Spacecraft Propulsion (Turner, Martin J. L., Springer)

Fundamentals of Electric Propulsion: Io and Hall Thrusters (Dan M. Goebel, I. Katz, Wiley)

### Ressources en bibliothèque

- [Fundamentals of Electric Propulsion: Io and Hall Thrusters \(Dan M. Goebel, I. Katz\)](#)
- [Space Propulsion Analysis and Design \(Humble, Henry & Larson\)](#)
- [Rocket and Spacecraft Propulsion \(Turner, Martin J. L.\)](#)

**Notes/Handbook**

Notes will be delivered prior to each course

**Moodle Link**

- <https://go.epfl.ch/ENG-510>