

EE-584

Spacecraft design and system engineering

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| Cursus | Sem. | Type |
|---|----------|------|
| Electrical and Electronical Engineering | MA1, MA3 | Opt. |
| Space technologies minor | H | Opt. |
| Systems Engineering minor | H | Opt. |

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|----------------------------|---------------------|
| Language of teaching | English |
| Credits | 4 |
| Session | Winter |
| Semester | Fall |
| Exam | During the semester |
| Workload | 120h |
| Weeks | 14 |
| Hours | 4 weekly |
| Lecture | 2 weekly |
| Practical work | 2 weekly |
| Number of positions | |

Summary

The main objective of the course is to learn to apply the fundamentals of space system engineering & design. The course introduces the various phases, systems, & subsystems involved in the design of spacecraft describing the techniques & best practices to plan and execute successful space missions.

Content**Introduction**

- Highlights of space mission organization and engineering.
- Mission objectives, science objectives, mission architectures.

Conception and Design of Spacecraft

- General description of the space environment and survivability, and spacecraft subsystems including science and instruments.
- Telecommunications, power management and distribution, command and data handling, thermal control, propulsion, structures and mechanisms, configuration, end-to-end information system, flight software.

System Engineering Techniques

- Presentation of the major system engineering techniques: functional analysis, block diagrams, design trade-offs, design budgets, interface management, tradable parameters.

Introduction to Project Engineering

- Other project considerations for a system engineer: requirement, definition and tracking, spacecraft integration and test, mission operations, reliability and quality assurance, cost and risk management.

Individual study of a Space Mission with deliverables and a final report including:

- Mission statement and definition, Project organization, Mission design, System Engineering, Science & instruments.
- Subsystems: Telecom, Electrical power, Structure and Configuration, C&DH, ADCS, Propulsion, Thermal.
- An executive summary and conference abstract.
- Powerpoint files for oral presentations at various stages.

Keywords

spacecraft, space system, space environment, orbital mechanics, and space exploration.

Learning Prerequisites

Required courses

- Space Mission Design and Operations (EE-585) [already taken or have registered for]

Recommended courses

- Systems Engineering (MICRO-405)

Learning Outcomes

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

- Structure a space project in development phases
- Formulate the tasks and responsibilities of the system engineer
- Dimension the overall system
- Dimension each satellite subsystem
- Elaborate a coherent and consistent system design
- Design a space mission
- Integrate constraints due to the space environment

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.
- Access and evaluate appropriate sources of information.
- Write a scientific or technical report.
- Make an oral presentation.
- Communicate effectively with professionals from other disciplines.

Teaching methods

- Interactive lectures
- Collaborative learning
- Project-based learning

Expected student activities

Design work every week, interactive presentations, mid-term report, final report, and final oral presentation.

Assessment methods

Mid-term report, final report, and oral presentation.

Supervision

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| Office hours | Yes |
| Assistants | Yes |

Resources

Bibliography

"Space Mission analysis and Design", by W. Larson and J. Wertz

Ressources en bibliothèque

- [Space Mission analysis and Design / Larson](#)

Moodle Link

- <https://go.epfl.ch/EE-584>