Course guide
300517 - ES - Systems Engineering

Last modified: 27/01/2026

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN SATELLITE ENGINEERING (Syllabus 2024). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Definit a la infoweb de l'assignatura.

Others: Definit a la infoweb de l'assignatura.

TEACHING METHODOLOGY

Participatory lectures
Problem and exercise solving
Autonomous and cooperative learning
Problem- and project-based learning
Experimental learning

LEARNING OBJECTIVES OF THE SUBJECT

Knowledge
K1. Understand the fundamental concepts of systems engineering, including the notion of a system and its life cycle.
K2. Know the main system life cycle models and systems engineering methodologies, as well as their scope of application.
K3. Understand the concepts of system requirements, system architecture, verification, validation and risk management.
K4. Understand the principles of sustainability and circular design as applied to the development, use and disposal of engineering systems and projects.
K5. Know the basic concepts of systems production, quality, applicable regulations and technical documentation.

Skills
S1. Analyse stakeholder needs and transform them into clear and verifiable system requirements.
S2. Propose and justify a system architecture suitable for a specific mission or problem.
S3. Apply systems engineering methodologies throughout the different phases of the life cycle of a system or project.
S4. Plan the development of a system project by defining phases, tasks, resources and milestones.
S5. Carry out integration, verification and validation activities using appropriate instrumentation and test procedures.
S6. Take into account use, maintenance, production, sustainability and end-of-life criteria in the design and evaluation of a system.

Competences
C1. Participate in the development of a system or subsystem project as part of a team, contributing to its definition, planning, implementation and evaluation.
C2. Make well-founded technical decisions within an engineering project, considering the entire system life cycle, including production, use, maintenance and disposal.
C3. Communicate clearly and in a structured manner, both orally and in writing, the project process, the decisions taken and the results obtained, including system limitations and impacts.

STUDY LOAD

Type	Hours	Percentage
Hours large group	28,0	22.40
Hours small group	27,0	21.60
Self study	70,0	56.00

Total learning time: 125 h

CONTENTS

Introduction to systems engineering

Description:
Engineering. Systems. Emergence. Complexity.
System life cycle.
System life cycle models: sequential, incremental, evolutionary and concurrent.
Systems engineering methodologies: Model-Based, Agile, Lean and Product-Line.

Full-or-part-time: 12h
Theory classes: 4h
Laboratory classes: 1h
Self study : 7h

Systems design

Description:
System mission. Stakeholder needs and requirements.
System requirements.
System architecture.
Design definition process.
System analysis, modelling and simulation.

Full-or-part-time: 29h
Theory classes: 6h
Laboratory classes: 8h
Self study : 15h

Systems implementation and testing

Description:
System implementation project and planning.
Team management.
Implementation: proof of concept, prototype, minimum viable product and TRL scale.
Integration.
Verification.
Transition and validation.

Full-or-part-time: 50h
Theory classes: 8h
Laboratory classes: 14h
Self study : 28h

Systems production

Description:
Production, scalability and cost.
Applicable regulations for product commercialisation.
Quality management.
Risk management.
Technical documentation.

Full-or-part-time: 17h
Theory classes: 5h
Laboratory classes: 2h
Self study : 10h

System operation, maintenance and disposal

Description:
System operation.
System maintenance and support.
System disposal.
Waste management and treatment.
Sustainability requirements and circular design.

Full-or-part-time: 17h
Theory classes: 5h
Laboratory classes: 2h
Self study : 10h

GRADING SYSTEM

Defined on the course infoweb

BIBLIOGRAPHY

Basic:
- The International Council on Systems Engineering (INCOSE). INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities. 5th. NJ, EUA: Wiley, 2023.
- SEBoK Editorial Board. The Guide to the Systems Engineering Body of Knowledge (SEBoK), v. 2.13. The Trustees of the Stevens Institute of Technology, 2025.

Complementary:
- Storey, Neil. Electronics : a systems approach. Sixth edition. Pearson Education, 2017.
- NASA. NASA Systems Engineering Handbook: NASA/SP-2016-6105 Rev2. NASA, 2017.
- Haberfellner, R., de Weck, O., Fricke, E. i Vössner, S.. Systems Engineering: Fundamentals and Applications. Springer International Publishing, 2019.

RESOURCES

Other resources:
Support material available on the digital campus: slides, collections of exercises and exams, laboratory and project guidelines.
Microcontroller programming environment.
Instrumentation testing and automatic control software. Project planning software.