



Course syllabus

Utveckling av komplexa tekniska produktssystem Development of Complex Technical Product Systems

MMKN70, 7,5 credits, A (Second Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED M

Date of Decision: 2023-04-11

General Information

Elective for: M4-pu, MD4

Language of instruction: The course will be given in English on demand

Aim

Complex product systems, that is, products that consist in a large number of components and of advanced technologies (e.g. within the automotive and aerospace industry), require specific principles, methods and tools for their development. In comparison with simpler products, it is for example necessary to deal with a very large number of specifications and to develop a product architecture that can integrate existing and new specifications during the whole product lifecycle. Risk analysis, simulation, verification and validation of such systems are moreover very challenging because the order of magnitude of those systems. Tight collaboration is needed between different disciplines and this requires a certain organisation with engineers who have an understanding for systems engineering in order to deal with this complexity, as well as substantial IT support systems.

This knowledge is important for future product developers who will most likely work directly or indirectly with such systems (whose number and types are steadily increasing) during their career. Increased degree of digitalization, artificial intelligence, sustainability aspects and circular economy are examples of trends that contribute to the need for increasingly complex and technologically advanced product systems. Such product systems are also often developed by virtual and global product development teams. In addition, these methods and tools are increasingly being

diffused and applied to less complex products. This requires that a product developer thoroughly understands systems engineering.

The main purpose of this course is to acquire knowledge and skills about the principles, methods and tools used in industry in the development of complex product systems.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- Use in an appropriate way the key terms and concepts within different industrial contexts
- Be able to compare different strategies for the development of complex product systems
- Have such insights into methods and techniques in systems engineering that the student is able to determine their role and significance in the development project of a complex product system

Competences and skills

For a passing grade the student must

- Structure, plan and implement the relevant methods and techniques based on a specific mission statement
- Apply key methods and techniques in the development of a complex product system
- Based on given conditions and in an appropriate way, report the process and results from the development project of a complex product system

Judgement and approach

For a passing grade the student must

- Critically reflect on one's contribution to the development project of a complex product system
- be able to independently assess the possibilities and limitations of the methods and tools presented in the course
- demonstrate the ability to critically reflect on the use of the course content for the development of products of less complexity

Contents

This course deals with the fundamentals of systems engineering as well as the related methods and tools that are used in most of the concerned industries. Many of the course activities are performed with practitioners. The course includes the following elements:

- Fundamentals of systems engineering (key concepts, management of large-scale system development projects, role of the systems engineer, processes)
- Methods and support for the development of complex product systems, such as requirements management, design activities in the development of large-scale systems, risk management and cost management
- System architecture, system integration, configuration management
- Simulation, testing, verification and validation of complex product systems
- Consideration of the entire lifecycle of the product

- Comparison with, and implications for, the development of less complex product systems

Teaching takes place in the form of lectures, guest lectures, self-study, seminars and exercises / group work.

The principles, methods and techniques are applied in a project that is carried out, if possible, in direct collaboration with an industrial company.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: The course includes a compulsory industrial project, which is carried out in groups of 4-6 students. The project work is graded with the TH scale (Fail, 3, 4 or 5). The project grade corresponds to the final grade of the course.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- MMKF01 Product Development and Design Methodology

The number of participants is limited to: No

Reading list

- Kossiakof A., Sweet W. N., Biemer S. B.: Systems Engineering Principles and Practice. Wiley, 2011, ISBN: Online ISBN: 9781118001028. Available via VPN or on campus:
<https://onlinelibrary.wiley.com/doi/book/10.1002/9781118001028>.
- NASA: NASA Systems Engineering Handbook. NASA. Latest version available at: <https://www.nasa.gov/connect/ebooks/nasa-systems-engineering-handbook>.

Contact and other information

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