

COURSE SYLLABUS

Advanced Software Engineering for AI, 7.5 credits*Avancerad mjukvaruutveckling för AI, 7.5 högskolepoäng*

Course Code:	T2AMFA	Education Cycle:	Second-cycle level
Confirmed:	Sep 01, 2025	Disciplinary domain:	Technology
Valid From:	Aug 30, 2027	Subject group:	Computer Technology
		Specialised in:	A1F Second cycle, has second-cycle course/s as entry requirements
		Main field of study:	Computer Science

Intended Learning Outcomes (ILO)

On completion of the course the student shall:

Knowledge and understanding

- demonstrate comprehension of advanced requirements engineering (RE) and advanced quality assurance (QA) practices for AI systems
- display knowledge of data management, data engineering, continuous training, model retraining, and lifecycle management, including the different options for cloud-based AI hosting platforms
- show familiarity with data governance, regulations, and responsible AI

Skills and abilities

- demonstrate the ability to design and manage continuous training pipelines, utilizing CI/CD and MLOps tools (e.g., MLFlow, Databricks), to manage model, data, and code lifecycles
- demonstrate the ability to debug and analyze failure cases to improve system robustness and reliability
- demonstrate skills of collaboration with interdisciplinary teams, ensuring alignment with business, operational goals, and regulations (data governance)

Judgement and approach

- demonstrate the ability to assess the trade-offs between performance, computing resources, reliability, and explainability in AI/ML-Enabled Systems.

Content

This course builds on the two previous courses Developing AI-Enabled Systems and AI Systems in Production. It explores advanced concepts in software engineering for AI/ML systems, focusing on quality, security, robustness, and reliability in production. It dives deeper into requirements engineering, QA processes, and advanced testing techniques for AI-enabled systems. Students will learn to implement continuous training, manage model lifecycles using MLOps frameworks, and address failure cases through robust debugging and analysis. Additionally, the course emphasizes interdisciplinary collaboration, data governance and regulations to ensure the development of responsible AI/ML-enabled systems.

The course includes the following elements:

- Advanced Requirements Engineering (RE) for AI/ML-Enabled Systems
- Advanced QA and System-Level Testing for AI/ML-Enabled Systems
- Continuous Training, Model Lifecycle Management, and Data Engineering
- MLOps: ModelOps, DataOps, and DevOps for AI
- Responsible AI and Ethical Governance

- Debugging and Failure Case Analysis

Type of instruction

The teaching mainly consists of lectures, assignments, and workshops.

Language of instruction is English.

Entry requirements

Passed courses at least 90 credits within the major subject computer engineering, computer science, informatics, information systems or information technology, including a minimum of 15 credits in mathematics and at least 30 credits in programming/software development, or alternatively passed courses at least 150 credits from the programme Computer Science and Engineering, and taken AI Systems in Production, 7.5 credits.

Examination and grades

The course is graded 5, 4, 3 or U.

Registration of examination:

Name of the Test	Value	Grading
Examination ¹	3.5 credits	5/4/3/U
Assignment	4 credits	G/U

¹Determines the final grade of the course, which is issued only when all course units have been passed.

Course literature

Please note that changes may be made to the reading list up until eight weeks before the start of the course.

Kästner, C. (2025). Machine learning in production: from models to products. MIT Press, <https://mlip-cmu.github.io/book/>.

Huyen, C. (2024). AI Engineering: Building Applications with Foundation Models. O'Reilly Media, Incorporated.

Bass, L., Lu, Q., Weber, I., & Zhu, L. (2025). Engineering AI systems: architecture and DevOps essentials. Addison-Wesley Professional.

Chip, H. (2022). Designing machine learning systems: An iterative process for production-ready applications.