Course Plan

Included in study programme
EVU-emne

*** Course name (Norwegian bokmål)**
Systems Engineering Industrial Digitalization and Digital Twin

*** Course name (English)**
Systems Engineering Industrial Digitalization and Digital Twin

*** Course code (FS)**

*** Course level**
Master level

Course scope and organisation

- Number of credits: 5
- Number of semesters
- Language of instruction: English
- Course organization: Online study with physical gatherings

Admission requirement:
Bachelor's degree in an exact science (realfag), technical, engineering or economic/administrative subject.

*** Academic content in course**

Digitalization is changing the way business and society works, but very much of the debate and knowledge around digitalization is linked to direct-to-consumer businesses. Industries – especially the natural resources and process industries – have different needs and a radically different IT landscape. This course therefore introduces the concept of industrial digitalization: how digitalization affects engineering, the process industries and the oil & gas industry. This introduction will give master's level students and practicing engineers, scientists and managers an overview of the key ideas, concepts, technologies and methods in industrial digitalization. This will enable them to be better-informed participants, stakeholders and customers in digitalization projects. The course will be structured around the use case of digital twin applications. Students in the course will work on proposing and defining a digital twin solution that is relevant to their work, technical or business interest. In doing this work they will apply the knowledge and methods acquired in the course.

This course gives an interdisciplinary, research-based overview of industrial digitalization. It gives enough technical depth that the student will be able to be a critical end-user of technology and interact intelligently with specialists in these technologies. In this way they can be bridge-builders between the IT, engineering and business stakeholders in a digitalization project. They can thus specify and run relevant, cost-effective and profitable digitalization projects. The course requires the intellectual maturity and specific skills gained through a master's degree in IT, engineering or business.

Web-based laboratory tasks and assignments will allow the student to gain a basic familiarity with common and standard tools for defining, designing and building digital twins. The students will be able to work with open data from real production facilities provided in a data portal.

CONTENT

- Digitalization and digital transformation
- Overview of "core basis" and "system technologies"

- The concept and architectures of the digital twin
- Using Industry 4.0 to understand digitalization and digital twins
- Characteristics and features of industrial datasets, with practical examples.
- Successful digitalization projects in industry
- The limitations of digitalization and its ethical implications

Prerequisites

We assume basic computer skills and knowledge of Office tools such as Excel. First-year university mathematics is assumed.

Learning outcome:

KNOWLEDGE
After completing this course the candidate is able to:

- Understand what digitalization and digital transformation mean in a complex industrial context.
- Describe the business and IT landscape in industry that provides the framework for digitalization.
- Understand in-depth the main ideas behind “core digitalization basis” and “system technologies” including artificial intelligence, machine learning, big data, cloud computing, digital twins and internet of things.
- Understand Industry 4.0 and its reference architectures for industrial digitalization.

SKILLS
After completing this course the candidate is able to:
Build a project justification, project plan, functional architecture and ethics case for a digital twin solution to an industrial business problem.

- Evaluate business proposals related to industrial digitalization.
- Critically assess the quality and usefulness of data and models used for industrial digitalization.
- Be able to use and understand functionality of selected, representative tools to design and build digital twin applications for industrial digitalization.
- Relate digitalization technologies (Core basis and systems technologies) and methods (such as digital twins and I4.0) to industrial business problems.

GENERAL COMPETENCE
After completing this course the candidate is able to:

- Explain the design and the design process of a digital twin.
- Collaborate with various stakeholders to create sustainable digital solutions for business, society and environment
- Communicate clearly about industrial digitalization to experts and non-experts.
- Understand the limitations and ethical challenges of artificial intelligence and other advanced technologies in industrial contexts.

Learning activities

- Five virtual gatherings of three hours (Lecturing, plenum discussions and supervised workshop in groups).
- Pre-read in advance of each gathering.
- Laboratory exercises and assignments after each gathering.
- Final delivery (written project report) building on the separate assignments, lectures and group work

Supervised professional training

- N/A

* **Coursework requirements**

- Attend lectures and active participation in group work.

- Hand in laboratory exercises and assignments after each gathering.
- Deliver final written project report

* **Compulsory activity and compulsory attendance**

- The student must attend all the sessions and participate actively in the group work. Maximum amount of session hours that can be missed is 3, duly justified.
- Students will need to achieve 'approved' (Godkjent) in the portfolio of laboratory exercises and practical assignments in order to be allowed to submit their written project assignment.

Course expenses

- N/A

* **Forms of assessment**

- Portfolio of laboratory exercises and practical assignments from each learning module. Graded approved/not-approved.
- Written report on project work, due four - ten weeks after last gathering. The report counts for 100% of the grade. The report will be graded A-F. F is failed.

Examination support material:

No restrictions.

* **Miscellaneous**

* **Literature**

Compendium prepared for the course.

Selected articles and research papers

* **Approved course plan**

Dato for godkjenning på fakultet:

Endringsbeskrivelse