COURSE SYLLABUS

Digitala Tvillingar

Digital Twins

7.5 credits (7,5 högskolepoäng)

Course code: MT2571
Main field of study: Mechanical Engineering
Disciplinary domain: Technology
Education level: Second cycle
Specialization: A1N - Second cycle, has only first cycle course/s as entry requirements

Subject area: Mechanical Engineering
Language of instruction: English
Applies from: 2021-01-18
Approved: 2020-10-01

1. Decision

This course is established by Dean 2020-08-31. The course syllabus is approved by Head of Department of Mechanical Engineering 2020-10-01 and applies from 2021-01-18.

2. Entry requirements

Admission to the course requires completed courses in Computer Aided design, CAD (Computer Aided Engineering for work), at least 6 credits, basic programming (eg. Java, Python, Matlab) at least 4 credits and mathematical statistics, 6 credits.

3. Objective and content

3.1 Objective

Digital twin is a concept that is used to depict a digital replica of a product in use. This concept is enabled by the enhanced ubiquity of sensors and connectivity of products, coupled with increased computing power and storage of data. By having a duplicate of the individual product in operation it is possible to see in real time the health of individual products and components and to apply analysis and simulations of different scenarios for maintenance, as well as support the development of the next generation of products.
The purpose of the course is to enable students to acquire knowledge and understanding about the Digital Twin concept, as well as to provide tools and methods suitable to develop a Digital Twin.
The course includes a mix of theory, methods and tools for Digital Twins, which are applied in an case of implementing and operating a digital replica of a product.

3.2 Content

- Introducing Industry 4.0
- Introducing Digital Twins
- Digital Twins as enablers for PSS
- Designing Digital Twins
- Deploying Digital Twins

4. Learning outcomes

The following learning outcomes are examined in the course:

4.1 Knowledge and understanding

On completion of the course, the student will be able to:
- Describe the transition to Industry 4.0 and its challenges and opportunities.
- Describe what digital twins are and their applications in industry.
- Understand the potential of digital twins in the context of design of complex systems

4.2 Competence and skills

On completion of the course, the student will be able to:
- Model the architecture of a digital twin through a process modelling language.
- Identify the functions of a digital twin and its boundaries.
- Perform the necessary steps of data gathering and data preparation prior to data analysis.
- Develop a digital twin application.

4.3 Judgement and approach

On completion of the course, the student will be able to:

- Reflect on the impact of digital twins in engineering decision making.
- Analyze the consequences that the availability of a digital twin has for system design and development.
- Identify and estimate the major risks related to a development and maintenance of a digital twin.
- Justify when the use of a digital twin is desirable.
- Discuss the feasibility of developing a digital twin.

5. Learning activities

Lectures and exercises are the basis where participants learn about concepts and theories that are relevant to a deeper understanding of digital twins.

Course assignments are performed individually and in groups where students are given the opportunity to actively perform, analyze and present their work under supervision.

Experiences from the assignments are shared during presentations in the classroom, while peer evaluation and group coaching (feed-forward) are used to stimulate critical reflection on process and results.

6. Assessment and grading

Modes of examinations of the course

Code	Module	Credits	Grade
2105	Project assignment 1	1.5 credits	GU
2115	Project assignment 2	2.5 credits	GU
2125	Project assignment 3	3.5 credits	AF

The course will be graded A Excellent, B Very good, C Good, D Satisfactory, E Sufficient, FX Fail, supplementation required, F Fail.

The course-PM for each course revision should include the assessment criteria and make explicit in which modes of examination that the learning outcomes are assessed.

An examiner can, after consulting the Disability Advisor at BTH, decide on a customized examination form for a student with a long-term disability to be provided with an examination equivalent to one given to a student who is not disabled.

7. Course evaluation

The course evaluation should be carried out in line with BTH:s course evaluation template and process.

8. Restrictions regarding degree

The course can form part of a degree but not together with another course the content of which completely or partly corresponds with the contents of this course.

9. Course literature and other materials of instruction

The course is based on theory- and work material (scientific articles and industry cases) that is distributed to students during the course.