Faculty of Health, Science and Technology
Mechanical Engineering

Syllabus

Data analysis and applied machine learning

Course Code:	MSAD25
Course Title:	Data analysis and applied machine learning *Dataanalys och tillämpad maskininlärning*
Credits:	7.5
Degree Level:	Master's level
Progressive Specialisation:	Second cycle, has only first-cycle course/s as entry requirements (A1N)

Major Field of Study:
MTA (Mechanical Engineering)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2026-02-18, and is valid from the Autumn semester 2026 at Karlstad University.

Prerequisites
Mathematics 22.5 credits, Introduction to programming (7.5 credits), Scientific programming (7.5 credits) or Numerical methods (7.5 credits), plus upper secondary level English 6 or English level 2. An equivalence assessment can be made.

Learning Outcomes
The aim of the course is for students to acquire knowledge about data-driven discoveries within engineering and science, as well as skills to create applicable data-driven models or systems.

Upon completion of the course, students should be able to
1. explain fundamental concepts and principles underlying classical machine learning methods such as linear regression, decision trees, and neural networks,
2. apply techniques for cleaning, transforming, and curating data in order to prepare technical datasets for machine learning programmes,
3. apply basic machine learning algorithms (e.g., regression, classification, clustering) to solve engineering-related problems,
4. design, train, and evaluate machine learning models using tools such as scikit-learn,
5. interpret model performance using metrics such as accuracy and precision, and
6. demonstrate awareness of the ethical, societal, and security-related implications of using machine learning in engineering contexts.

Content
- Introduction to machine learning
- Data management and pre-processing
- Supervised learning, such as regression models and classification techniques
- Unsupervised learning, such as k-means and hierarchical clustering
- Foundations of neural networks and deep learning
- Applied ML within the field of engineering
- Ethics and responsible AI

Reading List
See separate document.

Examination
Assessment is based on in-class quizzes, individual projects with focus on real-life engineering applications of machine learning, and an on-campus written exam where both theoretical understanding and practical skills are assessed.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades
One of the grades Pass with Distinction (5), Pass with Some Distinction (4), Pass (3), or Fail (U) is awarded in the examination of the course.

Quality Assurance
Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.