Faculty of Health, Science and Technology
Mechanical Engineering

Syllabus

Programming with mechanical engineering applications

Course Code:	MSAD31
Course Title:	Programming with mechanical engineering applications *Programmering med maskintekniska tillämpningar*
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), 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 of a modern high-level programming language with associated libraries, as well as the skills to apply this knowledge to solve mechanical engineering and material science problems. The main areas of application are non-linear structural analysis, vibrations, and production planning.

Upon completion of the course, students should be able to
- read and understand computer programmes written to solve mechanical engineering and material science problems,
- write and debug programmes to solve mechanical engineering and material science problems,
- understand programme dependencies and select appropriate programming libraries,
- perform versioning of programmes, for example, using Git,
- apply programming to process and visualise data,
- apply programming to perform statistical data analysis,
- apply programming to implement fundamental calculations within linear algebra and calculus,
- apply programming to solve differential equations,
- apply programming to solve non-linear equation systems, and
- apply programming to solve optimisation problems.

Content
The course imparts the required knowledge and skills to address typical scientific and practical mechanical engineering and material science problems within the modelling and simulation of systems with the help of computer programming in a modern, high-level programming language. Relevant technical case studies are introduced as part of the course.

The course is structured in three subsequent thematic blocks:

Block A - Programming
Addresses fundamental concepts in programming, such as control flow structures, data structures and processing,

programme structures, graphics and visualisation, and version control.

Block B - Computer mathematics
Introduces the fundamental mathematics required for modelling and simulation within mechanical engineering and material science, and how the commands and routines of the selected programming language can be used for mathematical calculations in statistics, linear algebra, and calculus.

Block C - Modelling and simulation
Covers several techniques useful for modelling and simulating mechanical engineering and material science problems with the help of the selected programming language, including interpolation and solving non-linear equation systems, differential equations, and optimisation problems.

Instruction is in the form of lectures, workshops, and laboratory sessions. Students will work independently with a project that runs throughout the course.

Reading List
See separate document.

Examination
Assessment is based on individual written assignments, an individual project report, and an individual oral exam. The individual written assignments and project report are discussed in an oral follow-up.

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's and Master's levels at Karlstad University stipulate the obligations and rights of students and staff.