



Faculty of Health, Science and Technology
Mathematics

Syllabus

Mathematics for Artificial Intelligence II

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| Course Code: | MAGA85 |
| Course Title: | Mathematics for Artificial Intelligence II <i>Matematik för Artificiell Intelligens II</i> |
| Credits: | 15 |
| Degree Level: | Undergraduate level |
| Progressive Specialisation: | First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F) |

Major Field of Study:
MAA (Mathematics)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2026-02-11, and is valid from the Autumn semester 2026 at Karlstad University.

Prerequisites

7.5 credits from Mathematics for artificial intelligence I (15.0 credits). An equivalence assessment can be made.

Learning Outcomes

Upon completion of the course, students should be able to:

- give an account of key concepts in probability theory, statistics, and optimisation,
- apply methods relevant to the course to solve given mathematical problems, and
- construct a logical chain of reasoning for a given mathematical statement.

Content

The course consists of two modules that provide prerequisite knowledge in mathematics for technical application courses in machine learning and artificial intelligence.

Module 1: Statistics and probability theory (7.5 credits)

The module covers the foundations of probability and statistics theory. Key concepts include random experiments, outcomes and events, probability functions, conditional probability, random variables, standard distributions (e.g., Poisson distribution, exponential distribution, and normal distribution), measures of central tendency and dispersion, point and interval estimation, and hypothesis testing for normally distributed populations.

Module 2: Optimisation (7.5 credits)

The module covers linear and nonlinear optimisation, with and without constraints. Key concepts include Taylor series, necessary and sufficient conditions for optimality, convergence, Newton's method, derivative-free methods, and stochastic gradient descent methods.

Reading List

See separate document.

Examination

Assessment is based on an individual on-campus written examination.

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 VG (Pass with Distinction), G (Pass), or U (Fail) is awarded in the examination of the course. For students in Engineering, one of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), or U (Fail) 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.