

## Artificial Intelligence (E016350)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 6.0**

**Study time 180 h**

**Course offerings and teaching methods in academic year 2025-2026**

A (semester 2)	English	Gent	lecture	0.0h
B (semester 2)	English	Gent		
C (semester 2)	English	Gent		

**Lecturers in academic year 2025-2026**

Pizurica, Aleksandra TW07 lecturer-in-charge

**Offered in the following programmes in 2025-2026**

	crdts	offering
<a href="#">Bachelor of Science in Engineering(main subject Biomedical Engineering)</a>	3	B
<a href="#">Bachelor of Science in Engineering(main subject Civil Engineering)</a>	3	B
<a href="#">Bachelor of Science in Engineering(main subject Computer Science Engineering)</a>	6	A, C
<a href="#">Bachelor of Science in Engineering(main subject Electrical Engineering)</a>	3	B
<a href="#">Bachelor of Science in Engineering(main subject Electromechanical Engineering)</a>	3	B
<a href="#">Bridging Programme Master of Science in Computer Science Engineering</a>	6	A
<a href="#">Master of Science in Industrial Engineering and Operations Research(main subject Manufacturing and Supply Chain Engineering)</a>	3	B
<a href="#">Master of Science in Industrial Engineering and Operations Research(main subject Transport and Mobility Engineering)</a>	3	B
<a href="#">Master of Science in Chemical Engineering</a>	3	B
<a href="#">Master of Science in Chemical Engineering</a>	3	B
<a href="#">Master of Science in Industrial Engineering and Operations Research</a>	3	B
<a href="#">Master of Science in Statistical Data Analysis</a>	3	B
<a href="#">Micro-credential Artificial Intelligence</a>	6	A
<a href="#">Preparatory Course Master of Science in Bioinformatics(main subject Engineering)</a>	3	B
<a href="#">Preparatory Course Master of Science in Biomedical Engineering</a>	3	B

**Teaching languages**

English

**Keywords**

Artificial Intelligence, Machine learning, Ethical dimension of AI, regression, classification, clustering, neural networks, reasoning under uncertainty, Bayesian reasoning

**Position of the course**

This course aims at providing insight in the fundamental concepts of the theory and applications in the broad Artificial Intelligence discipline. An overview of the most commonly used methods and models is presented, of which a number are treated in depth. Especially, focus is put on the topic Machine Learning and data driven model building, also addressing the limitations of these approaches. In addition, the A-offering of the course investigates search and decision problems.

**Contents**

Module 1: Introduction: survey of AI AI

- Survey of AI [A+B]
- Fundamental machine learning concepts (dataset, training set, validation set,

- dimensionality, overfitting, bias and variance, cross validation) [A+B]
- The rational agent concept [A]
- Introduction to search problems and games Inleiding [A]

#### Module 2: ML: Regression and Classification [A + B]

- Logistic regression
- Classification
- Clustering
- Construction of data driven models
  - white-box models and parameter estimation
  - black-box models (Perceptron and neural networks)

#### Module 3: ML: Reasoning under uncertainty [A+B]

- Bayesian reasoning and learning
- Bayesian networks and inference
- Design Of Experiment

#### Module 4: Societal context [A+B]

- Ethical dimension
- Limitations of AI/ML
- Illustrations

#### Module 5: Search problems [A]

- Informed search; local search
- Games (minimax, expectimax)

#### Module 6: Decisions and actions[A]

- Rationality, Decision networks
- Markovian Decision Problems (MDP)
- Reinforcement Learning (RL)

#### Module 7: More advanced AI [A]

- Reasoning over time; Prediction; Viterbi
- Fundamentals on Hidden Markov Models and Dynamic Decision networks
- Examples from Robotics and/or Computer vision and/or NLP

#### Initial competences

- Fundamentals on combinatorics, probability and statistics (e.g. as obtained through succeeding in the courses Discrete Mathematics I' and Probability and Statistics)
- Fundamentals on mathematical analysis (e.g. as obtained through succeeding in the courses Mathematical Analysis I and Mathematical Analysis II)
- Fundamentals on programming in Python (e.g. as obtained through succeeding in the course Informatics)

#### Final competences

- 1 Having an overall view on the different generic problem classes in the AI discipline [A+B]
- 2 Having insight in the fundamentals and concepts underlying commonly used solution techniques in this discipline, especially focussing on data driven model construction (white box as well as black box) [A+B]
- 3 Having a thorough understanding of search strategies, focussing on decision problems (Markovian Decision Problems and the connection to Reinforcement Learning, planning problems in dynamical environments). [A]
- 4 Solving specific problems in AI using the methods of this course (and extending these methods as needed in terms of applicability and context), as well on paper as in Python. [A+B]
- 5 Being able to assess the limitations and ethical consequences of AI-techniques. [A+B]

#### Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

#### Conditions for exam contract

This course unit cannot be taken via an exam contract

### Teaching methods

Seminar, Lecture, Independent work

### Study material

Type: Handbook

Name: Deep Learning: Foundations and Concepts  
Indicative price: Free or paid by faculty  
Optional: yes  
Language : English  
Author : Christopher M. Bishop and Hugh Bishop  
ISBN : 3-031-45467-7  
Number of Pages : 650  
Online Available : Yes  
Available in the Library : Yes  
Available through Student Association : Yes  
Usability and Lifetime within the Course Unit : regularly  
Usability and Lifetime within the Study Programme : regularly  
Usability and Lifetime after the Study Programme : regularly

Type: Handbook

Name: Artificial Intelligence: A Modern Approach (Global Edition), 4th Edition  
Indicative price: € 70  
Optional: yes  
Language : English  
Author : Stuart Russell and Peter Norvig  
ISBN : 1-292-40113-3  
Number of Pages : 1115  
Oldest Usable Edition : 3rd Edition  
Online Available : Yes  
Available in the Library : Yes  
Available through Student Association : Yes  
Usability and Lifetime within the Course Unit : regularly  
Usability and Lifetime within the Study Programme : regularly  
Usability and Lifetime after the Study Programme : regularly

Type: Syllabus

Name: Lecture Notes: Artificial Intelligence  
Indicative price: € 5  
Optional: yes  
Language : English  
Available on Ufora : No  
Online Available : No  
Available in the Library : No  
Available through Student Association : Yes

Type: Slides

Name: Slides for the course Artificial Intelligence  
Indicative price: Free or paid by faculty  
Optional: no  
Language : English  
Available on Ufora : Yes  
Available in the Library : No  
Available through Student Association : Yes

### References

- S. Russel and P. Norvig: Artificial Intelligence: A Modern Approach. Fourth Edition, Prentice Hall, 2020.
- A. Lindholm, N. Wahlström, F. Lindsten, and T.B. Schön. Machine Learning: A First Course for Engineers and Scientists. Cambridge University Press, 2022.
- C. Bishop and H. Bishop: Deep Learning - Foundations and Concepts, Springer, 2024.

### Course content-related study coaching

The lecturer is available before and after lectures. Interactive support through the

discussion groups on the electronic learning platform. Additional individual support is available if needed, on appointment.

#### **Assessment moments**

end-of-term and continuous assessment

#### **Examination methods in case of periodic assessment during the first examination period**

Written assessment

#### **Examination methods in case of periodic assessment during the second examination period**

Written assessment

#### **Examination methods in case of permanent assessment**

Skills test, Assignment

#### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is possible in modified form

#### **Extra information on the examination methods**

- **periodic evaluation:** Written exam (closed book, closed personal notes except summary on 1 page, A4 format)
- **permanent evaluation:** Evaluation of practical work in groups, spread over the semester, as well as individual home work assignments.

#### **Calculation of the examination mark**

In order to success in this course, a minimum score of 9/20 must be obtained for the PE (exam) AND the NPE (weighted score of practicum reports and home work assignments). In case the last condition is not met, but the end score would nevertheless result in 9 or more on a total of 20, the score is reduced to 8/20 (the highest score less than 9/20).

Participation to all parts of the evaluation is mandatory, if one fails to participate in 1 or more activities, one can not pass for this course.

Resit:

The weighing as described above is also used in the retake. Students who passed for the NPE-part, the scores for this part are taken into account for the 2nd exam period. Students who did not pass, have to independently take a skill test to evaluate the competences taught during het practicals.