

Degree programme	Type	Course
Bachelor in Artificial Intelligence	OB	4

Contact lecturer

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Teaching staff

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

Conceptual knowledge and fundamentals of programming, computational logic, and machine learning.

Objectives

This course introduces the fundamentals of autonomous agents and multi-agent systems, provides a detailed overview of their design, and offers the foundation for programming them in industrial or service-oriented production environments, integrating various concepts learned throughout the degree.

Learning outcomes

- CM16 (Design systems based on autonomous agents in artificial intelligence projects.) Design systems based on autonomous agents in artificial intelligence projects.
- CM17 (Incorporate ethical constraints and social values in the design of interaction strategies between agents, promoting transparency and equity.) Incorporate ethical constraints and social values in the design of interaction strategies between agents, promoting transparency and equity.
- KM33 (Describe the concepts necessary for the design and implementation of autonomous agents, including architectures, decision models, and learning.) Describe the concepts necessary for the design and implementation of autonomous agents, including architectures, decision models, and learning.
- KM34 (Identify the fundamentals of multi-agent systems related to game theory and negotiation and communication protocols between agents.) Identify the fundamentals of multi-agent systems related to game theory and negotiation and communication protocols between agents.
- SM38 (Apply knowledge representation, planning and learning algorithms in the design of autonomous agents in dynamic environments.) Apply knowledge representation, planning and learning algorithms in the design of autonomous agents in dynamic environments.

- SM40 (Evaluate agent performance using quantitative metrics and qualitative analysis.) Evaluate agent performance using quantitative metrics and qualitative analysis.
- SM41 (Use simulation platforms to model and analyse autonomous behaviours.) Use simulation platforms to model and analyse autonomous behaviours.
- SM42 (Analyse the ethical implications of decisions in autonomous agents.) Analyse the ethical implications of decisions in autonomous agents.

Contents

2. Intelligent Agents: Introduction.
4. BDI (Belief-Desire-Intention)
6. Behavior Trees
8. Agent Planning (STRIPS, GOAP, HTN)
10. Reinforcement Learning
12. Introduction to Multi-Agent Systems
14. Utility Theory
16. Game Theory
18. Communication: Fundamentals of Philosophy of Language, Speech Act Theory (Austin, Searle)
20. Automated Negotiation
22. LLM-based Agents

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Classroom practices	15	0.6	
Classroom lectures	30	1.2	
Individual preparation of written tests	13	0.52	
Teamwork	30	1.2	
Text readings	10	0.4	
Scheduled group tutorials	50	2	

Since the subject is mainly oriented to the learning of the basic techniques of designing and building software autonomous agents, the teaching methodology and the formative activities of the subject will combine: expositive lecture sessions (to guide and clarify doubts about compulsory readings), face-to-face practices (in classroom, in seminars, or in computer rooms), and applied teamwork. This teaching format allows to apply the concepts acquired and techniques explained, and will be combined throughout the course with tutorials of follow-up and autonomous work.

As the core of a challenge-based learning process, an Autonomous Agent Competition (AAC) will be organised

to test the performance of the different teamwork projects.

In this course, the use of Artificial Intelligence (AI) technologies is permitted as an integral part of work development, provided that the final result reflects a significant contribution from the student in terms of analysis and personal reflection. The student must clearly identify which parts were generated using this technology, specify the tools used, and include a critical reflection on how these tools influenced the process and final outcome of the activity. Lack of transparency regarding AI use will be considered academic dishonesty and may result in a penalty on the activity grade or more severe sanctions in serious cases.

Following are the different activities, with their specific weight within the distribution of the total time that the student has to dedicate to the subject.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Theory related written test 1st part	25%	1	0.04	KM33, KM34
Theory related written test 2nd part	25%	1	0.04	KM33, KM34
Practical works	50%	0	0	CM16, CM17, SM38, SM40, SM41, SM42

Evaluation of the course's achievement level for each student takes into account practical work as well as the scientific and technical knowledge of the subject. The final grade reflects this by combining the grades from the practical and theoretical parts as follows:

- (a) Theory test (1st exam) (25%)
- (b) Theory test (2nd exam) (25%)
- (c) Practical work (50%)

This course does not include the single assessment system.

To pass the course in the first sitting, it is mandatory to obtain at least a grade of 5 in the theoretical part (average of points (a) and (b)) and a 5 in the practical part (point (c)). The final grade will be calculated as the weighted average of the theoretical part (points (a) and (b)) and the practical part (point (c)).

In the second sitting, it is possible to retake any components (a), (b), or (c) with grades below 5. To successfully pass the course in the second sitting, the same criteria as the first sitting will apply. Additionally, it is important to note that the grade assigned to a retaken component will be capped at 5 (even if the final score is higher).

No Evaluation: The student's final grade will be "Not Submitted" if the student has not been evaluated in both written tests (a) and (b).

Honors: The awarding of an "Honors Distinction" (MH) is at the discretion of the course instructor. UAB regulations stipulate that an Honors Distinction can only be awarded to students who have obtained a final grade of 9 or higher and that no more than 5% of the total enrolled students may receive this distinction.

Plagiarism: Without prejudice to other measures deemed appropriate and in accordance with current academic legislation, irregularities committed by a student during an assessment activity may result in a grade of 0.

Assessment activities penalized in this manner cannot be retaken. If passing any of these assessment activities is required to pass the course, the student will fail the course without the possibility of retaking it in a second sitting within the same academic year. These irregularities include, but are not limited to:

- Copying, in whole or in part, a practical assignment, report, or any other assessment activity;
- Allowing others to copy your exercises/exam/work;
- Submitting a team assignment that was not entirely completed by the team members;
- Presenting materials produced by a third party as one's own, even if they are translations or adaptations, and generally any work containing non-original elements exclusive to the student;
- Using communication devices (such as mobile phones, smartwatches, tablets, etc.) during individual or team assessment activities.

If a student has committed irregularities in any assessment activity (and thus cannot pass the course, even in the second sitting), the final grade for the course will be the lower value between 3 and the weighted average of the grades. In summary: copying, allowing others to copy your work, or plagiarizing in any assessment activity results in a failing grade of 3 or lower.

Bibliography

Russell S. J. Norvig P. Chang M.-W. Devlin J. Dragan A. Forsyth D. Goodfellow I. Malik J. Mansinghka V. & Pearl J. (2022). Artificial intelligence: a modern approach (Fourth edition. Global). Pearson.

Wooldridge M. J. (2009). An introduction to multiagent systems (2. ed.). John Wiley & Sons.

Introduction to Automated Negotiation. Dave de Jonge.

Software

PyCharm, Visual Studio (or another IDE), PYTHON, UNITY.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	71	English	second semester	afternoon
(PAUL) Classroom practices	711	English	second semester	afternoon
(PLAB) Practical laboratories	711	English	second semester	afternoon