COURSE OUTLINE

GENERAL

SCHOOL	Sciences and Engineering		
ACADEMIC UNIT	Computer Science		
LEVEL OF STUDIES	1st Cycle		
COURSE CODE	COMP-405	**SEMESTER**	Fall
COURSE TITLE	Artificial Intelligence		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	2.5	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	COMP-221, COMP-270 and Senior Standing
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	

LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

After completion of the course students are expected to be able to:

- Formulate problems using formal representation techniques
- Analyze problem based on their characteristics
- Select and apply appropriate uninformed and informed search strategies to solve problems
- Construct and evaluate heuristic functions suitable for guiding informed search processes
- Design and implement AI-based problem-solving systems using appropriate search algorithms and representations.
- Demonstrate a critical understanding of the role of knowledge representation in the development of intelligent agents and reasoning systems.

- Apply predicate logic to formally represent knowledge and construct logical proofs for deductive inference.
- Explain, compare, and apply rule-based reasoning systems, highlighting their structure, limitations, and practical applications.
- Assess and apply methods of reasoning under uncertainty, including probabilistic techniques, to model incomplete or ambiguous information.
- Analyse and apply decision-making strategies for game environments, applying algorithms for deterministic and stochastic games including search and pruning techniques.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology

Adapting to new situations

Decision-making

Working independently

Production of new research ideas

Project planning and management

Criticism and self-criticism

Production of free, creative and inductive thinking

SYLLABUS

1. Overview of Artificial Intelligence: Definitions, Turing Test, History of AI, state-of-the-art, AI research areas.
2. Problems and Search: Defining a problem, state space representation, state space search, problem characteristics, uninformed search.
3. Informed Search: Heuristic searching, heuristic functions, hill-climbing search, best-first search, greedy search, A* search, admissible heuristics.
4. Knowledge representation issues: Knowledge Representation, Knowledge Bases, representations and mappings, requirements of a Knowledge Representation Language.
5. Logic: Propositional Logic, Inference rules, First-Order (predicate) Logic, inference in First-Order Logic.
6. Representing knowledge using rules: Rule-based system architecture, recognize-act cycle, forward and backward chaining.

7. Uncertain reasoning: Uncertainty, Probabilities and Baye's rule, Bayesian Network (structure, representation, and inference techniques), overview and comparison of other uncertain reasoning methods such as Fuzzy Logic and Dempster-Shafer Theory.
8. Game Playing: game playing as search (deterministic, 2-player games), minimax algorithm, Alpha-beta pruning, searching a game tree for stochastic games, expectiminimax. Overview of recent state-of-the-art advances in game playing including reinforcement learning and deep neural network approaches as exemplified by AlphaGo and AlphaGo Zero.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	*Use of ICT in teaching / Χρήση ΤΠΕ* *Communication with students / Επικοινωνία με Φοιτητές*
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	

Activity	***Semester workload***
Lectures	35
Preparation, homework, quizzes	60
Project	28
Exam preparation	25
Final Exam	2
Course total	***150***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	- Mid-term exam - Projects - Assignments - Final Exam

ATTACHED BIBLIOGRAPHY

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
S. Russell and P. Norvig	Artificial Intelligence: A Modern Approach (4th ed)	Pearson	2021	978-1292401133

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
D. Poole and A. Mackworth	Artificial Intelligence: Foundations of Computational Agents (3rd ed.).	Cambridge University Press	2023	978-1009258197
G. F. Luger	Artificial Intelligence: Structures and Strategies for Complex Problem Solving (6th Edition)	Addison Wesley	2008	0321545893