# ADVANCED TOPICS IN ARTIFICIAL INTELLIGENCE

## COURSE OUTLINE

| 1. GENERAL | | | |
|---|---|---|---|
| **SCHOOL** | School of Engineering | | |
| **ACADEMIC UNIT** | Department of Electrical and Computer Engineering | | |
| **LEVEL OF STUDIES** | Undergraduate | | |
| **COURSE CODE** | 8000.1.121.0 | **SEMESTER** | 2nd |
| **COURSE TITLE** | Advanced Topics in Artificial Intelligence | | |

| **INDEPENDENT TEACHING ACTIVITIES**<br>if credits are awarded for separate components of the course | **WEEKLY TEACHING HOURS** | **CREDITS** |
|---|---|---|
| | 5 | 7.5 |
| **Total** | **5** | **7.5** |

| | |
|---|---|
| **COURSE TYPE**<br>general background, special background, specialised general knowledge, skills development | |
| **PREREQUISITE COURSES** | All students are expected to have background from the following undergraduate courses: Algorithms, Data Structures, Discrete maths, Logic and Introduction to AI. |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS** | English |
| **OFFERED TO ERASMUS STUDENTS** | Yes (in English) |
| **COURSE WEBSITE (URL)** | https://eclass.hmu.gr/courses/TP281/ |

## 2. LEARNING OUTCOMES

**Learning outcomes**

The students are expected to get the required knowledge in order to be able to develop projects and to carry out research in selected, state of the art topics of AI. That is, in *Machine Learning* and in particular in Statistical relational learning.

**General Competences**

The primary aim of this course is to teach students advanced techniques of modern AI. In addition, it equips students with the appropriate programming tools for developing AI applications. Moreover, the course fosters an appreciation for the engineering issues underlying the design and development of AI systems.

## 3. SYLLABUS

Overview of Machine Learning. Statistical Relational Learning. Probability Theory & Bayes' Rule. Probability & Random Variables. Reasoning under Uncertainty I. Reasoning under Uncertainty II. Probabilistic Graphical Models - Bayesian Networks. Markov Networks. Probabilistic Inference. Probabilistic Logic Programming: ProbLog, Cplint. Implementation of Markov Models & HMM.

## 4. TEACHING and LEARNING METHODS - EVALUATION

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|---|---|
| **DELIVERY**<br>Face-to-face, Distance learning, etc. | Lectures using power-point slides. |

<table>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY<br>Use of ICT in teaching, laboratory education, communication with students</td><td>Programming, Word and Power-point are used for developing assignments. Internet is used for assignments and lectures. For example, eClass is used for uploading lectures, assignments, bibliography etc.</td></tr>
<tr><td>TEACHING METHODS<br>The manner and methods of teaching are described in detail.</td><td><table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Assignments and projects</td><td>7</td></tr>
<tr><td>class attendance</td><td>5</td></tr>
<tr><td>Course total</td><td>12</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION<br>Description of the evaluation procedure</td><td>• 4 assignments 40% (each assignment is graded 10%).<br>• 1 project 60%.</td></tr>
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## 5. ATTACHED BIBLIOGRAPHY


1. D. Poole, A. Mackworth, *Artificial Intelligence – Foundations of Computational Agents*, Cambridge University Press, Third Edition, 2023.
2. S. Russell, P. Norving, *Artificial Intelligence – A Modern Approach*, 4th edition, Pearson, 2022.
3. M. P. Deisenroth, A. A. Faisal, C. S. Ong, *Mathematics for Machine Learning*, Cambridge University Press, 2020.
4. G. Bontempi, *Handbook of Statistical Foundations for machine Learning*, Comp. Science Department, Universite Libre de Bruxelles, Belgique, 2017.
5. L. De Raedt, K. Kersting, S. Natarajan, D. Poole, *Statistical Relational Artificial Intelligence*, Morgan & Claypool Publ, 2016.
6. D. Koller, N. Friedman, *Probabilistic Graphical Models – Principles and Techniques*, The MIT Press, 2009.
7. L. De Raedt, *Logical and Relational Learning*, Springer, 2008.
8. D. Bertsekas, J. Tsitsiklis, *Introduction to Probability*, 2nd Edition, Athena Scientific, 2008.
9. L. Getoor, B. Taskar, *Introduction to statistical relational learning*, The MIT Press, 2007.