# SYLLABUS

**1. Data about the program of study**

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| 1.1 Institution | The Technical University of Cluj-Napoca |
| 1.2 Faculty | Faculty of Automation and Computer Science |
| 1.3 Department | Computer Science |
| 1.4 Field of study | Computer Science and Information Technology |
| 1.5 Cycle of study | Bachelor of Science |
| 1.6 Program of study/Qualification | Computer science/ Engineer |
| 1.7 Form of education | Full time |
| 1.8 Subject code | 42. |

**2. Data about the subject**

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| 2.1 Subject name | | | | ***Intelligent systems*** | |
| 2.2 Course responsible/lecturer | | | | Prof. dr. eng. Leţia Ioan Alfred – Ioan.Alfred.Letia@cs.utcluj.ro | |
| 2.3 Teachers in charge of seminars/ laboratory/ project | | | | Assoc.prof. dr. eng. Razvan Slăvescu – Razvan.Slavescu@cs.utcluj.ro<br>Assoc.prof. dr. eng. Anca Marginean – Anca.Marginean@cs.utcluj.ro | |
| 2.4 Year of study | III | 2.5 Semester | 2 | 2.6 Type of assessment (E - exam, C - colloquium, V - verification) | E |
| 2.7 Subject category | *DF – fundamentală, DD – în domeniu, DS – de specialitate, DC – complementară* | | | | DS |
| | *DI – Impusă, DOp – opțională, DFac – facultativă* | | | | DI |

**3. Estimated total time**

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|---|---|---|---|---|---|---|---|---|---|---|
| 3.1 Number of hours per week | 4 | of which: | Course | 2 | Seminars | | Laboratory | 2 | Project | |
| 3.2 Number of hours per semester | 56 | of which: | Course | 28 | Seminars | | Laboratory | 28 | Project | |
| 3.3 Individual study: | | | | | | | | | | |
| (a) Manual, lecture material and notes, bibliography | | | | | | | | | | 18 |
| (b) Supplementary study in the library, online and in the field | | | | | | | | | | 5 |
| (c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays | | | | | | | | | | 10 |
| (d) Tutoring | | | | | | | | | | 6 |
| (e) Exams and tests | | | | | | | | | | 5 |
| (f) Other activities: | | | | | | | | | | 0 |

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| 3.4 Total hours of individual study (suma (3.3(a)…3.3(f))) | 44 |
| 3.5 Total hours per semester (3.2+3.4) | 100 |
| 3.6 Number of credit points | 4 |

**4. Pre-requisites (where appropriate)**

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| 4.1 Curriculum | Logic Programming, Functional Programming |
| 4.2 Competence | Fundamentals of Computer Programming |

**5. Requirements (where appropriate)**

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| 5.1. For the course | Projector, Computer |
| 5.2. For the applications | Computers with Linux, Specific Software |

**6. Specific competence**

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| 6.1 Professional competences | **C6 –** Design of intelligent systems (4 credits)<br>**C6.1 –** Describing the components of intelligent systems<br>**C6.2 –** Usage of specific instruments of the domain for explaining and understanding the functioning of intelligent systems<br>**C6.3 –** Application of principles and basic methods for the specification of solutions typical problems using intelligent systems<br>**C6.4 –** Choosing criteria and methods for the evaluation of quality, performance and limits of intelligent systems<br>**C6.5 –** Development and implementation of professional designs for intelligent |

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| | systems |
| 6.2 Cross competences | N/A |

**7. Discipline objective (as results from the *key competences gained*)**

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| 7.1 General objective | Knowledge of representation and reasoning of fundamental problems of intelligent systems |
| 7.2 Specific objectives | Fundamental methods for basic representations in intelligent systems: uncertainty, learning, communication |

**8. Contents**

| 8.1 Lectures | Hours | Teaching methods | Notes |
|---|---|---|---|
| Introduction. | 2 | Slides, Algorithms, Quality of solutions, Exceptions, Limits in the representation of the real world | |
| Uncertainty: inference using full joint distributions, Bayes' rule and its use. | 2 | | |
| Probabilistic Reasoning: semantics of Bayesian networks, efficient representation, exact inference, approximate. | 2 | | |
| Probabilistic Reasoning over Time: hidden Markov models, dynamic Bayesian networks. | 2 | | |
| Making Simple Decisions: utility functions, decision networks, value of information. | 2 | | |
| Making Complex Decisions: value iteration, policy iteration, partially observable MDPs, game theory. | 2 | | |
| Learning from Observations: learning decision trees, ensemble learning. | 2 | | |
| Knowledge in Learning: explanation-based, relevance information, inductive logic programming. | 2 | | |
| Statistical Learning Methods: hidden variables, instance-based, neural networks, kernel machines. | 2 | | |
| Reinforcement Learning. | 2 | | |
| Association analysis: frequent itemset generation, rule generation, compact representation of frequent itemsets, alternative methods of generating frequent itemsets, FP-growth algorithm. | 2 | | |
| Communication: syntactic analysis, semantic interpretation. | 2 | | |
| Perception, representation and action in multi-agent systems. | 2 | | |
| Overview on Intelligent Systems: Present and Future. | 2 | | |
| Bibliography<br>1. Artificial Intelligence: A Modern Approach: Russell, Norvig, Prentice Hall, 2002<br>2. Tan, Steinbach, Kumar: Data Mining: Association Analysis, 2004 | | | |
| 8.2 Applications – Seminars/Laboratory/Project | Hours | Teaching methods | Notes |
| Introduction to the documentation for the assignment | 2 | Platform, Documentation, Testing, Examples, New examples | |
| Studying the documentation for the assignment | 2 | | |
| Studying the design of the tool | 2 | | |
| Practicing the exercises provided in the archive | 2 | | |
| Understanding the main parts of the software | 2 | | |
| Running the system by tracing at high level | 2 | | |
| Mastering the running of the system and the examples provided | 2 | | |
| Conceptual design of new examples | 2 | | |
| Code for the new examples | 2 | | |
| Testing and debugging the new cases | 2 | | |
| Measuring the performance of the system | 2 | | |
| Documenting the new scenarios | 2 | | |
| Comparison of the differences between the cases developed and those provided | 2 | | |
| Final evaluation of the exercises developed | 2 | | |
| Bibliography | | | |

1. Various Intelligent Systems Tools from the WWW.

*Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.

**9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field**

The course outline represents the most known and used one in the world methods for intelligent systems, continuously assessed by the research community in the world regarding its influence and use in software technology.

**10. Evaluation**

| Activity type | Assessment criteria | Assessment methods | Weight in the final grade |
|---|---|---|---|
| Course | Problems and theoretical concepts | Moodle + email | 75% |
| Seminar | | | |
| Laboratory | Usage of specific tools on the examples developed and tested by the students | Moodle | 25% |
| Project | | | |

Minimum standard of performance:
Representation of knowledge and its use in solving specific intelligent systems problems using specific tools.
Grade calculus: 25% laborator + 75% examen final
Conditions for participating in the final exam: Laborator ≥ 5
Conditions for promotion: grade ≥ 5

| **Date of filling in:** | **Titulari** | **Titlu Prenume NUME** | **Semnătura** |
|---|---|---|---|
| | Course | Prof. dr. eng. Leţia Ioan Alfred | |
| | Applications | Assoc.prof. dr. eng. Razvan Slavescu | |
| | | Assoc.prof. dr. eng. Anca Marginean | |

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| **Date of approval in the department** | Head of department<br>Prof.dr.ing. Rodica Potolea |
| **Date of approval in the Faculty Council** | Dean<br>Prof.dr.ing. Liviu Miclea |