SYLLABUS

1. Data about the program of study

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

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 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

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
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)

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

5. Requirements (where appropriate)

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

6. Specific competence

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

	performance and limits of intelligent systems **C6.5 –** Development and implementation of professional designs for intelligent systems
6.2 Cross competences	N/A

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

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: representing knowledge in an uncertain domain, semantics of Bayesian networks, efficient representation of conditional distributions, exact inference in Bayesian networks, approximate inference in Bayesian networks, extending probability to first-order representations	2		
Making Simple Decisions: combining beliefs and desires under uncertainty, basis of utility theory, utility functions, multi-attribute utility functions, decision networks, value of information, decision-theoretic expert systems	2		
Making Complex Decisions: sequential decision problems, value iteration, policy iteration, partially observable MDPs, decision-theoretic agents, decisions with multiple agents - game theory	2		
Learning from Examples: forms of learning, inductive learning, learning decision trees, ensemble learning, computational learning theory	2		
Knowledge in Learning: logical formulation of learning, explanation-based learning, learning using relevance information, inductive logic programming	2		
Artificial Neural Networks: perceptrons, multilayer perceptrons, backpropagation, distributed representation, continuous bag-of-words model, one word context, multi-word context, skip-gram model	2		
Natural Language for Communication: formal grammar for a fragment of English, syntactic analysis, augmenting a grammar, semantic interpretation, convolutional layers, recurrent neural networks, LSTM, GRU, recursive neural networks	2		
Dynamic Protocols for Open Agent Systems: event calculus, resource-sharing protocol, dynamic resource-sharing	2		
Commitments in Multiagent Communication for Interaction: commitment guaranteed alignment, synthesizing protocols, commitment operationalization	2		
Dispute Resolution using Argumentation-Based Mediation: BDI architecture for argumentation, agent theories, bridge rules, mediation system	2		
Value-based Plan Selection in BDI Agents: goals and plans, values, extending AgentSpeak, finding a best course of action	2		
Explainable AI	2		

Bibliography

1. Artificial Intelligence: A Modern Approach: Russell, Norvig, Prentice Hall, 2010
2. Goldberg. A Primer on Neural Network Models for Natural Language Processing, JAIR, 2016

8.2 Applications – Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Introduction to the documentation for the assignment	2	Platform, Documentation, Testing, Examples, New examples, online	
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 + zoom	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	

Date of approval in the department	Head of department Prof.dr.ing. Rodica Potolea
Date of approval in the Faculty Council	Dean Prof.dr.ing. Liviu Miclea