Course Title	Advanced Topics in Knowledge Representation and Reasoning				
Course Code	AI630				
Course Type	Elective				
Level	Master (2nd Cycle)				
Year / Semester	1st Year/2nd Semester or 2nd Year/1st Semester				
Teacher's Name	TBA				
ECTS	7	Lectures / week	Up to 6 Teleconferences	Laboratories / week	None
Course Purpose and Objectives	Knowledge representation and reasoning (KR) is the field of artificial intelligence dedicated to representing information about the world in a form that computer systems can manipulate and utilize to solve complex tasks such as making decisions, diagnosing a medical condition, finding suitable answers to queries or having a dialog in a natural language. Specific KR languages have been developed to express representations. Once information representations are established, reasoning algorithms can be applied to draw conclusions from the available information in a traceable, explainable way. Each KR language is supported by such reasoning algorithms. KR is at the heart of the area of the semantic web, and has found deployment in big corporations such as Google and Amazon in the form of knowledge graphs. Building on the introductory module on Knowledge Representation, this module will enable learners to familiarize themselves with advanced principles and algorithms of knowledge representation and reasoning, and gain experience in using them to solve practical problems.				
Learning Outcomes	Upon successful completion of this course students should be able to: ● Define the principles of logic programming, nonmonotonic reasoning, description logics and belief revision ● Discuss the principles of Ontology Web Language (OWL) ● Choose an appropriate KR method to solve specific problems ● Explain important KR tools ● Apply OWL to practical problems ● Recall major trends in KR and symbolic AI				
Prerequisites	AI610	Co-requisites	None		
Course Content	Resolution 1: inference, clausal form, unification, unsatisfiability, resolution principle. Resolution 2: examples, soundness & completeness Resolution strategies: unit, input, linear, SLD, Prolog.				

	Nonmonotonic reasoning: motivation, main approaches. Defeasible reasoning 1: basic ideas, proof theory, properties, SPINDL tool. Defeasible reasoning 2: variants, semantics, applications. Answer set programming 1: Well-Founded Semantics, Answer Sets, basic Answer-Set Programming (ASP), applications, DLV tool. Answer set programming 2: ASP extensions (weak negation, constraints, aggregates), complexity, ASP versus SAT solvers. Ontology Web Language OWL: limitations of RDF Schema, OWL profiles, developing OWL ontologies with Protégé. Description logics 1: basic ideas, ALC, tableau-based reasoning query answering Description logics 2: subsumption, richer description logics, relation to OWL profiles. Belief revision 1: AGM postulates, epistemic entrenchment orderings, iterated revision. Belief revision 2: other belief revision approaches, revision over knowledge bases, revision for non-classical logics All lectures will consist of a theoretical part presenting concepts and techniques and a practical part were the AI techniques will be applied for problem solving.
Teaching Methodology	E-Learning
Bibliography	“Logical Foundations of Artificial Intelligence”, Morgan Kaufmann, by Michael Genesereth and Nils Nilsson, Latest Edition “Handbook of Knowledge Representation”, Elsevier, by Frank van Harmelen, Vladimir Lifschitz and Bruce Porter, Latest Edition “A Semantic Web Primer” (Third edition), MIT Press, by Grigoris Antoniou, Paul Groth, Frank van Harmelen and Riinke Hookstra, Latest Edition

Assessment	Final Examination	50%
	Assignments/On-going evaluation	50%
		100%
Language	English	