RTU Course "Logical Foundations of Intelligent Robots"

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General data

Code	DSP723
Course title	Logical Foundations of Intelligent Robots
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Agris Ņikitenko
Academic staff	Maija Strautmane
Volume of the course: parts and credits points	1 part, 3.0 credits
Language of instruction	LV
Annotation	The direction of artificial intelligence which has the goal to develop intelligent systems that think rationally is based on first-order logic. Many different intelligent systems are based on first-order logic, too. The study course deals with intelligent robots and intelligent robotic systems that are based on first-order logic, construction of knowledge base, inference rules, reasoning such as forward and backward chaining, and resolution, agent design and planning with a focus on intelligent robots. Insight is given on higher-order logics and logics for multiagent systems to which systems consisting of several robots belong.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to provide students with knowledge of intelligent robots and robotic systems rooted in first and higher-order logic and to develop the ability to develop such components of the system as the knowledge base and inference mechanism. Tasks of the study course are to provide knowledge and skills: - for first and higher-order logic applications; - for retrieving knowledge using first and higher-order logic; - in the use of first and higher-order logic judgments; - in the use of situation invoices; - for the use of logic in robotic systems.
Structure and tasks of independent studies	Students must work out a course work in which he/she, using first-order logic, must construct a knowledge base for an intelligent robot and implement such inference mechanisms as forward and backward chaining, and resolution in logical and planning agents which are modules of intelligent robotic system.
Recommended literature	Obligātā/Obligatory: 1. Russell S. and Norvig P. Artificial Intelligence. A Modern Approach. Prentice Hall, New Jersey, 2003. 2. Luger G.F. Artificial Intelligence. Structures and Strategies for Complex Problem Solving, 5th edition. Addison Wesley, Harlow, England, 2005. 3. Brachman R.J., Levesque H.J. Knowledge Representation and Reasoning. Morgan Kaufmann Publishers, 2004. 4. Read C. Logic, Deductive and Inductive. Nabu Press, 2010. 5. Hurley P.J. A Concise Introduction to Logic. Wadsworth Publishing, 2011.
Course prerequisites	Students must know syntax and semantics of propositional and predicate logic.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
First-order logic-based intelligent robots and intelligent robotic systems.	2	2	0	0
Knowledge representation in first-order logic language in intelligent robots and robotic systems.	8	2	0	0
Application of inference rules in first order logic.	8	2	0	0
Application of output mechanisms in first order logic (direct and inverse inference, resolution).	8	4	0	0
Design of an agent that implements the functionality of intelligent robots using first-order logic.	8	4	0	0
Application of first-order logic in the development of planning agents for applications in robotic systems.	8	4	0	0
Application of higher order logic and situation calculations.	8	4	0	0
Application of logic in the development of multi-agent systems with applications in systems made of several robots.	6	2	0	0
Total:	56	24	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Knows first-order logic-based structure of intelligent robotic systems.	Practical work, questions of the theoretical part of examination.
Is able to develop a knowledge base for an intelligent robot using first-order logic.	Practical work, defence of course work, questions of the theoretical part of examination.

Knows inference rules and is able to use reasoning in first-order logic for the development of intelligent robots.	Practical work, defence of course work, questions of the theoretical part of examination.
Is able to design agents which implement the functionality of intelligent robots using first-order logic.	Practical work, defence of course work, questions of the theoretical part of examination.
Is able to use first-order logic in planning for the development of intelligent robots.	Practical work, defence of course work, questions of the theoretical part of examination.
Knows basics of higher-order logics and logics for multiagent robotic systems.	Practical work, questions of the theoretical part of examination.

Evaluation criteria of study results

Criterion	%
Practical work	50
Defence of course work	25
Exam	25
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	1.0	1.0	0.0		*	