RTU Course "Intelligent Electronic Equipment in Robotic Systems"

33000 Faculty of Computer Science, Information Technology and Energy

General data

Code	EEI358
Course title	Intelligent Electronic Equipment in Robotic Systems
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Ingars Steiks
Academic staff	Pēteris Apse-Apsītis Valdis Priedols
Volume of the course: parts and credits points	1 part, 4.5 credits
Language of instruction	LV, EN
Annotation	The study course covers not only control systems of the mobile robot that include fuzzy logic and artificial neurons, but also include practical examples of their design and implementation.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to introduce various control systems of mobile robots. Tasks of the study course: to acquaint with mobile robot hardware (which includes sensors, actuators and controllers) and its software, as well as to develop the ability to perform practical tasks with fuzzy logic and artificial neural controllers in a dynamic environment.
Structure and tasks of independent studies	Students prepare for the exam, perform small tasks strengthening theoretical knowledge in the development of a simple program-controlled system in accordance with the considered topic, prepare for laboratory work.
Recommended literature	Obligātā/Obligatory 1. Intelligent Control Systems using Computational Intelligence Techniques. Edited by A.E.Ruano. The Institution of Electrical Engineers, 2005. 454 lpp. 2. Thomas Braunl. Embedded Robotics, Mobile Robot Design and Applicarions with Embedded Systems, Second Edition. Springer, 2006. 458 lpp. 3. Bill Drury. The Control Techniques Drives and Controls Handbook, Second Edition. The Institution of Electrical Engineers, 2009. 724 lpp.
Course prerequisites	Electronics, electric drive, computer science.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Introduction into intelligent electronic equipment. Identification of non-linear systems.	2	2	1	3
Modules of fuzzy logic and their design.	2	2	1	3
Fuzzy logic controllers.	2	2	1	3
Artificial neural networks.	2	2	1	3
Identification of control systems of non-linear robots and their control by means of artificial neural networks.	2	2	1	3
Adaptive control of non-linear dynamic systems.	2	2	1	3
Identification of non-linear control systems with local linear neuro-fuzzy modules.	2	2	1	3
Design and calculation of neuro-fuzzy modules.	2	2	1	3
Complex computer intelligence and analytical methods of errors identification.	2	2	1	3
Identification of mobile robot control system localization with the help of navigating programs.	2	2	1	3
Built-in robotic systems. Traditional control methods.	2	2	1	3
Multitask programming and wireless communication models.	2	2	1	3
Modeling systems of mobile robots.	2	2	1	3
Identification of real time processes. Generic algorithms in the robots control systems.	2	2	1	3
Genetic programming and event-based robots control systems.	2	2	1	3
Artificial intelligent in robots control systems.	2	2	1	3
1. Lab. work. Searching for parking place of an autonomous robot using intelligent control systems.	7	7	4	10
2. Lab.work. Investigation of software of autonomous robot motion route identification.	7	7	4	10
3. Lab.work. Investigation of control systems of a walking robot.	7	7	4	10
4. Lab.work. Fuzzy-logic controller of a mobile robot.	7	7	4	10
Total:	60	60	32	88

Learning outcomes and assessment

Learning outcomes	Assessment methods
Is able to understand the essence of fuzzy logic theory and can design fuzzy logic controllers.	Test No.1. Passed an exam.

Is able to understand the essence of artificial neural networks and can apply control systems of artificial neural networks robots.	Test No.2. Passed an exam.
Is able to understand control navigation programs of mobile robots and to apply robots modeling systems.	Test No.3. Passed an exam.
Is able to develop generic algorithms in robot control systems and realize its programming for further realization.	Test No.4. Passed an exam.
Is able to realize autonomous parking for the mobile robot control systems.	Laboratory work No.1.
Is able to realize autonomous path planning for the mobile robot control systems.	Laboratory work No.2.
Is able to realize object identification for the mobile robot control systems.	Laboratory work No.3.
Is able to realize fuzzy-logic controllers for the mobile robot control systems.	Laboratory work No.4.

Evaluation criteria of study results

Criterion	%
Test No.1	6
Test No.2	6
Test No.3	6
Test No.4	6
Lab.work 1	15
Lab.work 2	15
Lab.work 3	15
Lab.work 4	15
Exam	16
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	4.5	2.0	0.0	1.0		*	