RTU Course "Foundations of Computer and Robotic Systems Design"

33000 Faculty of Computer Science, Information Technology and Energy

General data

Code	DSP724
Course title	Foundations of Computer and Robotic Systems Design
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Agris Ņikitenko
Volume of the course: parts and credits points	1 part, 3.0 credits
Language of instruction	LV
Annotation	The study course provides the basic knowledge and skills necessary to independently evaluate the design of robotic system alternatives and technical solutions for the project. The main design methods, evaluation and acquisition methods of alternatives are considered within the study course.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to provide students with general knowledge of the design process, methodologies, standard procedures and design systems used in the design of computer systems and robotic systems. Tasks of the study course: - to provide knowledge about design methods and their applications; - to provide knowledge of the system life cycle and general characteristics of technical systems; - to provide skills for the application of different methods; - to provide knowledge and skills for obtaining and evaluating alternatives to a technical solution.
Structure and tasks of independent studies	Students must work out a course work in which he/she must choose and practically implement the appropriate method of design to get the optimal solution for the robotic system.
Recommended literature	Obligātā/Obligatory: 1. Duffy A.H.B. and O'Donnell F.J.A. Design Research Approach. In: Critical Enthusiasm - Contribution to Design Science, 1999, pp. 33-40. 2. Goel A.K. et al. Functional Explanation in Design. In: Proceedings of IJCAI-97 Workshop on Modeling and Reasoning about Functions, 1997, pp. 1-10. 3. Goel A.K. Design, Analogy and Creativity. IEEE Expert Special Issue on AI in Design, 1997, pp. 0-25. 4. Falting B. Qualitative Models in Conceptual Design: A Case Study. Ecole Polytechnique Federale de Lausanne, Switzerland, 1991. 5. Shuzhi Sam Ge and Lewis F.L. Autonomous Mobile Robots. CRC Press, Taylor & Francis, 2006. 6. Siegwart R. and Nourbakhsh I.R. Introduction to Autonomous Mobile Robots. A Bradford Book, The MIT Press, 2004. 7. A.Dashinsky, Solving Product Design Exercises: Questions & Answers, Independently published 2018, 170 pages. 8. B.E.Burdek, Design: History, Theory and Practice of Product Design, Birkhäuser; 2nd ed. edition 2015, 296 pages.
Course prerequisites	Students must know general conceptions of graph theory and special types of graphs.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Principles, tasks and process of design.	2	0	0	0
Description and hierarchical levels of design objects.	2	0	0	0
Foundations of design methodologies.	2	2	0	0
Top down, bottom up, internal and external design.	2	4	0	0
Methods and models of conceptual design.	2	4	0	0
Models and life cycles of computer and technical systems.	4	4	0	0
Routes, modes and typical procedures of design.	4	0	0	0
Creation methods in design.	2	0	0	0
Computer-aided design (CAD) systems.	2	8	0	0
Analysis and description methods of functions of technical systems and elements.	4	2	0	0
Morphological analysis and synthesis of technical solutions.	4	4	0	0
Methods of optimal decision making in design.	4	2	0	0
Foundations of knowledge-based (intelligent) design.	4	0	0	0
Methods of robotic systems design.	4	2	0	0
Methods of development of autonomous robots.	4	0	0	0
Integration of robotic systems.	2	0	0	0
Total:	48	32	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Knows theoretical foundations and methodologies of design.	Questions of the theoretical part of examination.
Is able to describe an object of design and its functions.	Course work and its defence, questions of the theoretical part of examination.
Knows creation methods in design.	Questions of the theoretical part of examination.
Is able to choose and apply appropriate methods of design and methods of optimal decision making.	Course work and its defence, questions of the practical part of examination.
Knows methods of knowledge-based (intelligent) design.	Questions of the theoretical part of examination.
Is able to choose methods and develop robotic systems design.	Course work and its defence, questions of the theoretical part of examination.
Knows methods of development of autonomous mobile robots and methods of integration of robotic systems.	Questions of the theoretical part of examination.

Evaluation criteria of study results

Criterion	%
Course work and its defence	75
Examination	25
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	2.0	0.0	0.0		*	