RTU Course "Theory of Systems and Processes"

12307 Sistēmu teorijas un projektēšanas katedra

General data

Code	DSP411
Course title	Theory of Systems and Processes
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Post-graduate Studies
Course type	Academic
Field of study	Computer Science
Responsible instructor	Grundspeņķis Jānis
Volume of the course: parts and credits points	1 part, 4.0 Credit Points, 6.0 ECTS credits
Language of instruction	LV, EN
Possibility of distance learning	Not planned
Abstract	The goal of systems and process theory is to develop a general system structure and functioning description methods which are founded on system thinking that allows to consider all the relevant factors for the system operation. In this course students get acquainted with philosophical foundations of system theory as well as with general and specific system theories. They also acquire basic conceptions of the system structure, classification, laws, rules and principles, general characteristics of system functioning, mathematical models and analysis of system structure, and basics of structural modeling and multilevel flow modeling.
Goals and objectives of the course in terms of competences and skills	The goal of the course is to give theoretical knowledge and practical skills in description methods of system structure and functioning, which are based on systems thinking.
Structure and tasks of independent studies	Students independently must work out the course work which consists of three tasks: students must choose a real system, describe it and develop the mathematical model of its structure. They must also perform topological and qualitative analysis of structure and construct models of morphological and functional structure using structural modeling approach. The course work must be submitted before the examination session and its assessment constitutes 40% of final assessment.
Recommended literature	1. Fenton, N.E., Hill, G. Systems Construction and Analysis: A Mathematical and Logical Framework. Mc Graw-Hill, 1993, 465 p. 2. Skyttner, L. General Systems Theory: Problems, Perspectives, Practice. World Scientific Publishing Company, 2006, 536 p. 3. Bose, N.K. Multidimensional Systems Theory and Applications. Springer, The Netherlands, 2009, 292 p.
Course prerequisites	Systems notion and basics of systems thinking

Course outline

Theme	Hours
Philosophical foundations of systems theory	2
Goals and basic conceptions of general systems theory	2
Specific approaches to systems theory	4
Basic notions of systems structure	4
System laws, rules and principles	4
System classification and system classes	4
Complex system structure and its mathematical models	10
Topological analysis of structure	8
Qualitative analysis of structure	8
Basics of process theory	2
General characteristics of complex system functioning	6
Basic principles and models of structural modeling	6
Multilevel flow modeling	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students know philosophical foundations of systems theory, goals and basic conceptions of general systems theory, as well as specific approaches to systems theory	Goals of general systems theory must be formulated and specific approaches to systems theory must be characterized in examination
Students know basic notions of system structure and can use them for real world systems	Description of chosen system structure must be created in practical and course works
Students know system laws, rules and principles	System laws, rules and principles must be explained in examination

Students know nature and goal of system classification and most important system classes	Test work
Students can develop mathematical model of system structure and carry out its topological and qualitative analysis	Mathematical model of system structure must be developed and its topological and qualitative analysis must be carried out in practical and course works
Students can apply basic principles of structural modeling and create models of morphological and functional structure	Models of morphological and functional structure must be created in practical and course works
Students know basics of multilevel flow modeling	Test work

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	4.0	6.0	3.0	1.0	0.0		*	