COURSE UNIT DESCRIPTION

Course unit title	Course unit code
Computational Intelligence and Decision Making	SISP3124

Lecturer(s)	Department where the course unit is delivered
Coordinator: assoc. prof. dr. Olga Kurasova **Other**: dr. Valdas Dičiūnas	Department of Computer Science Faculty of Mathematics and Informatics

Cycle	Type of the course unit
1st (BA)	Optional

Mode of delivery	Semester or period when the course unit is delivered	Language of instruction
Face-to-face	6th semester	Lithuanian, English

Prerequisites
Prerequisites: basic knowledge of mathematical statistics and programming skills

Number of credits allocated	Student's workload	Contact hours	Individual work
5 ECTS	130	66	64

Purpose of the course unit: programme competences to be developed

To provide knowledge about computational intelligence and decision making, to develop abilities to solve various data analysis problems applying computational intelligence methods and to make the reasoned decisions when analysing results of data analysis.

Generic competences:

- Ability to analyse and organise the information *(GK1).*
- Ability to apply the knowledge in practice *(GK2).*
- Ability to organise and plan the work, to work in a team as well as individually *(GK3).*

Specific competences:

- Analysis and applications of continuous and discrete mathematical structures *(SK4).*
- Mathematical and computer modelling (*SK10*).
- Human factors and artificial intelligence (*SK11*).

Learning outcomes of the course unit: students will be able to	Teaching and learning methods	Assessment methods
Will be able to perform a search of literature related to computational intelligence and decision making and to systematize the information found.	Lectures Laboratory works Individual literature reading Individual work	Project (practical tasks) Mid-term exam Exam
Will be able to apply the acquired knowledge on computational intelligence to solving practical data analysis problems.		
Will be able to plan the work, to work individually and in groups, when performing the practical tasks related to computational intelligence methods.		
Will be mastered mathematical structures and algorithms necessary for the investigation and		

application of computational intelligence techniques.		
Will be able to estimate quantitatively the effectiveness of computational intelligence methods in various application areas.		
Will be able to identify the main computational intelligence methods, to use them in solving data classification, recognition, prediction and clustering problems, and make the reasoned decisions.		

Course content: breakdown of the topics	**Contact hours**							**Individual work: time and assignments**	
	Lectures	Tutorials	Seminars	Practice	Laboratory work (LW)	*Tutorial during LW*	**Contact hours**	**Individual work**	**Assignments**
1. The main terms and concepts, related to computational intelligence and decision making. Relations of computational intelligence and artificial intelligence.	4				4		**8**	**8**	Individual literature search and analysis. Solving of practical classification, recognition, prediction, and clustering problems applying computational intelligence methods (project planning and performing). Preparation of the written work. Presentation of the results obtained.
2. Basics of the data analysis. Data pre-processing. Formulation of classification, recognition, prediction, and clustering problems and their solving techniques.	4				4		**8**	**8**	
3. Artificial neuron model, its relation with biological neuron. Connection of artificial neurons to neural networks. Classification of neural networks and their training types.	4				4		**8**	**8**	
4. Single layer perceptron, its training, and application to solve simple classification problems.	4				4		**8**	**8**	
5. Multi-layer feed-forward neural networks, their training, and application to solve classification, recognition, and prediction problems.	6				6		**12**	**12**	
6. Self-organizing neural networks (maps), their training, and application to visualize and cluster data.	4				4		**8**	**8**	
7. Basics of fuzzy logic and their application in decision making.	2				2		**4**	**4**	
8. Peculiarities of solving of practical data analysis problems, applying computational intelligence methods.	4				4		**8**	**8**	
9. Mid-term exam							**1**		
10. Exam							**1**		
Total	**32**				**32**		**66**	**64**	

Assessment strategy	**Weight %**	**Deadline**	**Assessment criteria**
Project (practical tasks)	50	Five times during the semester (at 3, 5, 9, 13, 16 weeks)	The students must perform project (consisted of practical tasks) in groups. The following aspects are assessed: • structure of the written work (the structure are clear and logical, there are all the necessary parts (work aim, tasks,

			description of experiments, results, conclusions, contribution to group work), the work is properly formatted, • results, their analysis, and conclusions (the analysis of the results is comprehensive, the conclusions are reasoned), • project presentation (consistent, reasoned, and logical, the important aspects are emphasized), • answers to the questions (comprehensive and reasoned). Project must be submitted and assessed in some parts until the specified time. A delay of 2 weeks reduces the score by 25%, 4 weeks - 50%, 6 weeks - 75%. The project submitted later will not be assessed.
Mid-term exam	20	Middle of the semester	The questionnaire consists of 10-20 open and closed-ended questions. Answers must be comprehensive and reasoned.
Exam	30	Exam session	The exam is allowed to take, if the project and mid-term exam are assesed no less than 50% of the possible scores. The questionnaire consists of 10-20 open and closed-ended questions. Answers must be comprehensive and reasoned. Examples of the applications of the methods must be presented.

Author	**Publishing year**	**Title**	**Number or volume**	**Publisher or URL**
Required reading				
Olga Kurasova	2017	Computational Intelligence and Decision Making		Virtual Learning Environment of Vilnius University https://moodle.esec.vu.lt/
Recommended reading				
Andries Engelbrecht	2007	Computational Intelligence: An Introduction		Wiley & Sons, New York
Zhengxin Chen	1999	Computational Intelligence for Decision Support		Support RC Press
Šarūnas Raudys	2001	Statistical and Neural Classifiers		Springer, New York
Stuart Russell, Peter Norvig	2009	Artificial Intelligence: A Modern Approach, (3rd edition).		Pearson Prentice Hall