Subject code	ECTS credits
MAT5001	6

Course title in Lithuanian

EILIŲ TEORIJA

Course title in English

QUEUING THEORY

Short course annotation in Lithuanian (up to 500 characters)

Įgyjamos teorinės ir praktinės žinos apie eilių modelius ir jų parametrų vertinimą bei optimizavimą. Analizuojant konkrečius atvejus, suformuojami įgūdžiai taikyti eilių teoriją įvairiose praktinėse srityse.

Short course annotation in English (up to 500 characters)

Acquired deeper theoretical and practical knowledge of queuing models and evaluation of its parameters and optimization. The analysis of particular cases forms skills to apply queuing theory in various practical areas.

Prerequisites for entering the course

Probability Theory, Mathematical Statistics

Course aim

Course aim is to provide deeper knowledge of queuing theory and its application.

Links between course outcomes, criteria of learning achievement evaluation, study methods and methods of learning achievement assessment

No	Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1	Theoretical knowledge of mathematical models in queuing theory.	Student knows the general notions, theoretical assumptions and results.	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical work
2	Ability to develop mathematical models and estimate its parameters for a particular queuing.	Student knows ability to develop mathematical models and estimate main parameters (mean waiting time, mean response time, etc.) for a particular queuing.	Lectures, practical works, individual work, consulting	Mid-term exam, Assessment of practical work
3	Ability to perform analysis of a particular queuing system (case study analysis), to estimate main parameters and to develop correspondent queuing system based on related statistical data.	Student demonstrates the ability to formulate task, gather needed statistical data and perform its analysis, present solution process, justify received results, present research work.	Lectures, practical works, individual work, consulting	Final exam, assessment of practical work

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome		
	1	2	3
1. Deepen and expand general knowledge of mathematics and apply it in a new non-standard environment	+	+	+
3. Broaden and apply the knowledge of reliability analysis and statistical methods for data analysis	+	+	+
4. Identify, select and understand the state-of-the-art literature of mathematics and apply the gained knowledge to specific scientific and practical tasks	+		+
5. Develop mathematical models integrating the knowledge from various fields and different mathematical modelling techniques, and analyse the modelling results assessing the model adequacy and accuracy		+	+

7. Analyse, understand and use mathematical methods	+	+	+
9. Critically evaluate personal results and professional experience and other persons' activity			+
12. Make decisions independently			+
13. Take moral responsibility for the results of work			+

Content

No	Content (topics)
1.	Flow models.
2.	Birth and death processes.
3.	Queuing system basic characteristic's calculations.
4.	Theoretical study of waiting lines.
5.	Multiple channel queuing models.
6.	Erlang distribution and its applications.
7.	Stage method.
8.	Queuing systems with any service time distribution.
9.	Marked Markov processes.
10.	Queuing systems with any input time distribution.
11.	Group marking method.
12.	General queuing theory.
13.	Kingman's queuing algebra.

Distribution of workload for students (contact and independent work hours)

Lectures	**45 hours**
Practical work	**15 hours**
Individual students work	**100 hours**
Total:	**160 hours**

Structure of cumulative score and value of its constituent parts

Final written exam (50%), mid-term written exam (25%), assessment of practical work (25%).

Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	*Self study rooms*	*Other libraries*
Basic materials						
1.	1996	Hock N. C. Queuing Modelling Fundamentals	Wiley		1	
2.	1994	Kalashnikov V. V. Mathematical Methods in Queuing Theory	SPRINGER-SCIENCE+BUSINESS MEDIA, B.V.		1	(google books)
3.	1979	Клейнрок Л. Теория массового обслуживания (in English, Queueing theory)	Машиностроение, Москва		1	
Supplementary materials						
1.	2015	I. Adan, J. Resing. Queueing Systems		Free online access www.win.tue.nl/~iadan/queueing.pdf		
2.	2008	Gross D., Shortle J. F., Thompson J. M., Harris C. M. Fundamentals of Queueing Theory	John Wiley & Sons, Inc.			

3.	1961	Хинчин А.Я. Математические методы теории массового обслуживания (Mathematical methods of queuing theory)	Изд. АН, Москва	

Course programme designed by

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