Subject code	ECTS credits
MAT6004	6

Course title in Lithuanian

LAIKO EILUTĖS

Course title in English

TIME SERIES

Short course annotation in Lithuanian (up to 500 characters)

Šio kurso tikslas yra suteikti studentams teorinių ir praktinių žinių, reikalingų analizuojant duomenis matematiniais metodais. Kursas apima tokias temas: stacionarios sekos, koreliacinės funkcijos, tiesinės transformacijos ir procesai, spektrinės funkcijos analizė, prognozavimas, parametrinis ir neparametrinis vertinimas.

Short course annotation in English (up to 500 characters)

Course objective – introduce to the most important statistical methods for analysis of economic data. The course includes lectures and practical work. The main topics are: stationary sequences, correlation functions, linear transformations and processes, spectral function analysis, forecasting, parametric and nonparametric estimation.

Prerequisites for entering the course

Probability theory, Mathematical statistics

Course aim

Course aim is to provide deeper knowledge of stationary processes and statistical time series analysis, develop students' skills in analytical thinking.

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

Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1. Fit linear models to time series data.	Student demonstrates the ability to perform initial statistical analysis of time series data and build linear time series models	Lectures, practical works, individual work,	Mid-term exam
2. Test statistical significance of parameters and adequacy of fitted models	Student demonstrates the ability to estimate correlation functions, fit time series model and test its adequacy	Lectures, practical works, individual work,	Mid-term exam
3. Perform spectral function analysis	Student demonstrates the ability to estimate spectral function using parametric and nonparametric methods	Lectures, practical works, individual work,	Exam
4. Validate time series model and apply it for prediction	Student demonstrates the ability to apply model selection and validation criteria and make predictions using the best model	Lectures, practical works, individual work	Exam
5. Present report of performed study	Student demonstrates the ability to formulate task, present solution process, justify received results	Individual work, self-study of literature, discussions, consulting	Essay presentations

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome				
	1	2	3	4	5
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	+	+	+	+	+
11. Convey mathematical information to specialists of different fields orally and/or in written form, critically evaluate it					+
13. Take moral responsibility for the results of work					+

Content

No	Content (topics)
1.	Notion of stationarity.
2.	Basic characteristics of stationary sequences.
3.	Spectral decomposition of stationary sequences.
4.	Linear transformations.
5.	Singularity and regularity.
6.	Wold decomposition.
7.	Linear forecasting.
8.	Nonparametric estimation of spectral density.
9.	Parametric estimation of spectral density.
10.	Statistical estimation of linear model parameters.
11.	Testing hypothesis on order of model.
12.	Forecasting by using parametric models.
13.	Estimation of trend function and periodical components
14.	Testing stationarity hypothesis.
15.	Multivariate time series.

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%), and assessments of homework 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.	1998	N.Kligienė. *Įvadas į atsitiktinių sekų statistinę analizę.*	Technika	1	2	
2.	2013	R. Leipus. Ekonometrija II (Paskaitų konspektai), 2013, Vilnius, 117 p.		http://www.statistika.mif.vu.lt/wp-content/uploads/2014/04/R.Leipus_EKOII.pdf		
Supplementary materials						
1.	2016	B.E.Hansen. Econometrics		http://www.ssc.wisc.edu/~bhansen/econometrics/		
2.	2016	R.H. Shumway, D.S. Stoffer.		http://www.stat.pitt.edu/stoffer/tsa4/tsaEZ.pdf		

		Time Series Analysis and Applications Using the R Statistical Package.		
3.	2013	A.W. van der Vaart. Time series.	Universeit Leiden	*http://www.math.leidenuniv.nl/~avdvaart/timeseries/dictaat.pdf*

Course programme designed by

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