COURSE UNIT DESCRIPTION

Course unit title	Course unit code
Probability Theory and Mathematical Statistics I	TTMS2114

Lecturer(s)	Department where the course unit is delivered
Coordinator: Vytautas Stepas **Other lecturers:**	Faculty of Mathematics and Informatics Institute of Mathematics Naugarduko St. 24 LT-03225 Vilnius Lithuania

Cycle	Level of course unit	Type of the course unit
1st (BA)	1 out of 2, SK	Compulsory
Mode of delivery	**Semester or period when the course unit is delivered**	**Language of instruction**
Face-to-face	Second year of study Spring semester	Lithuanian, english

Prerequisites and corequisites	
Prerequisites: Mathematical Analysis I-III	**Corequisites (if any):** Theory of Functions of Complex Variable, Measures and Integrals Theory

Number of ECTS credits allocated	Student's workload	Contact hours	Individual work
5	150	64	86

Purpose of the course unit: programme competences to be developed

The aim of the course is to develop key mathematical skills related to random events, random variables and its sequences.

Learning outcomes of the course unit: students will be able to	Teaching and learning methods	Assessment methods
The student abstract thinking ability will be developed. The students will learn to employ mathematical reasoning, that is, to proceed from assumptions to conclusions following the patterns of logical inference.	Interactive Lecture. Practice. Individual reading.	Tests (written). Colloquium (written) Exam (written).
Define and illustrate main concepts related to random events and random variables.	Interactive Lecture. Practice. Individual reading.	Tests (written). Colloquium (written) Exam (written).
Apply the elements of measure and integral theory in probability theory.	Interactive Lecture. Practice. Individual reading.	Tests (written). Colloquium (written) Exam (written).
Formulate and prove main propositions on the distribution of random objects. The students will learn to rigorously construct their mathematical arguments.	Interactive Lecture. Practice. Individual reading.	Tests (written). Colloquium (written) Exam (written).
Create the probabilistic model of experiment, make the calculations and to draw conclusions, solve typical problems of probability theory. Make and justify conclusions (implications) based on the analysis of the relevant mathematical model.	Interactive Lecture. Practice. Individual reading.	Tests (written). Colloquium (written) Exam (written).

Course content: breakdown of the topics	Contact hours						Individual work: time and assignments	
	Lectures	Tutorials	Seminars	Practice classes	Exam	**Contact hours**	**Individual work**	**Assignments**
1. Probability models and axioms.	4			4		8	6	Individual reading Problem solving
2. Conditional probabilities. Total probability and Bayes' rules.	2			2		4	4	Individual reading Problem solving
3. Independence.	2			2		4	4	Individual reading Problem solving
4. Counting.	2			2		4	4	Individual reading Problem solving
5. Discrete random variables; Probability Mass Functions; expectations.	2			2		4	6	Individual reading Problem solving
6. Discrete random variable examples.	2			2		4	4	Individual reading Problem solving
7. Multiple discrete random variables: expectations, conditioning, independence.	4			4		8	6	Individual reading Problem solving
8. Continuous random variables.	4			4		8	6	Individual reading Problem solving
9. Multiple continuous random variables.	2			2		4	4	Individual reading Problem solving
10. Continuous Bayes' rule; derived distributions.	2			2		4	4	Individual reading Problem solving
11. Derived distributions; convolution; covariance and correlation.	4			4		8	4	Individual reading Problem solving
12. Sum of a random number of random variables.	2			2		4	6	Individual reading Problem solving
Total	**32**			**32**		**64**	**86**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Tests (written)	30	During semester	Assessment: 3 – excellent knowledge and abilities; 2,5 – strong knowledge and abilities; 1,5 – mediocre knowledge and abilities; 0,5 – minimal knowledge and abilities; < 0,5 – minimal requirements are not satisfied.
Work in lecture-room	10	During semester	Assessment: 1 – excellent work in lecture-room; 0,5 – mediocre work in lecture-room; < 0,5 – unsatisfactory work in lecture-room.
Colloquium (written)	20	April	Assessment: 2 – excellent knowledge and abilities; 1,5 – strong knowledge and abilities; 1 – mediocre knowledge and abilities; 0,5 – minimal knowledge and abilities; < 0,5 – minimal requirements are not satisfied.
Exam (written)	40	June	Assessment: 4 – excellent knowledge and abilities; 3 – strong knowledge and abilities; 2 – mediocre knowledge and abilities; 1 – minimal knowledge and abilities; < 1 – minimal requirements are not satisfied.

Author	Publishing year	Title	Number or volume	Publisher or URL
Required reading				
J. Tsitsiklis	2010	Probabilistic Systems Analysis and Applied Probability		https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-041-probabilistic-systems-analysis-and-applied-probability-fall-2010/index.htm
Recommended reading				
M. Loève	1979	Probability theory		New York, Springer
W. Feller	1970	An intruduction to probability theory and its application		New York, Willey
J. Kubilius	1996	Tikimybių teorija ir matematinė statistika		Vilniaus universiteto leidykla
D. Bertsekas, J. Tsitsiklis	2008	Introduction to probability, 2nd ed.		Nashua (NH, USA), Athena Scientific