STUDY PROGRAMME DESCRIPTION

Title of the study programme	State code of the study programme
Mathematics	6211AX002

Official name of the awarding institution	Language(s) of instruction
Vilnius University	Lithuanian, English

Kind of study	Study cycle	Level of qualification under the Lithuanian Qualification Framework
University studies	Second	VII

Mode of studies; Length of the study programme (in years)	Study programme volume in credits	Total student's workload (in hours)	Contact hours	Self-study hours
Full-time, 2	120	3120	864	2256

Study area	Study field	Branch of study field
Physical sciences	Mathematics	-

Qualification degree/Professional qualification awarded
Master of Mathematics

Programme director	Contact information
Prof., dr. Artūras Štikonas	**arturas.stikonas@mif.vu.lt**

Accrediting body	Period of accreditation
Centre for Quality Assessment in Higher Education	31 August 2023

Aim of the study programme	
To train qualified specialists who have advanced knowledge in pure and applied mathematics as well as strong problem solving skills so that they can successfully tackle challenging scientific, industrial, economic problems.	
Content of the study programme: course unit groups	**Distinctive features of the study programme**
The programme graduates are expected to be also successful in pure mathematics (differential equation, number theory, numerical analysis, abstract algebra, functional analysis) and applied mathematics areas (mathematical modelling, statistics, public finance). The purpose of the entire programme is to develop a scientific attitude; therefore, the big part of courses is devoted to the theoretical foundation of the various methods and techniques. **In the first and second semester** students get advanced knowledge in pure mathematics (functional analysis, differential equations, number theory, probability theory) (30 ECTS credits) and knowledge in *mathematical writing at higher level* and *parallel computing* (10 credits). **In the third semester**, students get acquainted with the *Probability theory and mathematical statistics* and learn to work with *Statistical packages* (15 credits).	The programme provides a solid background applicable branches of mathematics (differential equations, number theory, probability theory), develops necessary skills for research and applications. Courses of Pure Mathematics in Study Programme make about two-thirds of the course. Much attention is paid to the theory of various equations (functional, differential, integral, stochastic) and various methods (numerical, variational, asymptotic) for solving such equations. Deeper studies are in Number theory, Measure theory, Probabilistic models.

During the first two semesters master students select optional courses (20 credits): *Probabilistic Combinatorics*, *Integral Equations*, *Analytic Number Theory, Mathematics in modern finance, Stochastic Processes Theory, Numerical Methods for Differential Equations, Risk Theory, Variational Methods for Nonlinear Phenomenons.* **In the third semester** master students select one optional course (5 credits): Fundamentals of Scientific Research in *Problems of Number Theory and Probability Theory* or *Models of Mathematical Physics* and two optional courses (10 credits) from the list (*Weak Convergence of Measures*, *Dynamical Systems, Graph Theory, Stochastic Differential Equations*, *Mathematical Theory of Navier-Stokes Equations, Asymptotic Methods for Partial Differential equations*). Optional courses allow a master student to specialize in the narrower field of mathematics (Number theory, Differential equations and so on). Students must prepare **master thesis** (30 credits) during the last semester. *Master's Thesis Seminar* and *Master's Thesis* make the base of Scientific research. Whole programme consists of Pure mathematics 64%, Applied mathematics 27%, Informatics 9%	Scientific research in number theory, differential equations and numerical analysis is realized. The Master's thesis can be both from the pure mathematics, both from the applied mathematics.

Admission requirements	Recognition of prior learning
Bachelor degree is typically required. Bachelors of mathematics, statistics, economics, or physics wishing to study mathematics and having sufficient proficiency are also welcome. Competition grade is formed from the entrance exam grade (E) Appendix grades (except thesis) average (VS), extra points (P), according to the formula E+VS+P.	Formally or informally acquired competencies are recognized as long as they agree with the programme.

Access to further studies
Graduates of the Master programme in Mathematics will be able to study in doctoral (PhD) studies in mathematics, informatics and related areas of physical sciences.

Employability
Will be able to work in science and education institutions, high-technology industries, agencies of data analysis and social investigations, management institutions. Graduates will also be able to pursue a career in any other sphere, where their mathematical knowledge, analytical skills and ability to use specialized software are needed.

Teaching and learning methods	Assessment methods
Lecture, tutorials, problem solving, modeling, case studies, individual reading, supervision.	Written tests and examinations, presentations, master thesis.

Study programme generic competences developed		Study programme learning outcomes	
1.	**Abstract and critical thinking skills**	1.1	Will be able to think abstractly for solving various problems and to decide whether existing methods are applicable.
		1.2	Will be able to apply critical thinking skills to solve problems that can be modelled mathematically.
2.	**Life-long learning skills**	2	Will be able to acquire new knowledge, to examine, understand and master the new non-standard methods.
3.	**Communication and collaboration skills**	3.1	Will be able clearly communicate mathematical ideas, research ideas in appropriate contexts both orally and in writing to a range of audiences.
		3.2	Will be able to work independently and in interdisciplinary team, generate ideas, integrate knowledge and skills.
Study programme subject specific competencies developed		**Study programme learning outcomes**	
4.	**Advanced theoretical knowledge mathematics (theory, methods)**	4.1	The student has advanced and in-depth knowledge and understanding of complex theories, models, methods in areas of pure and/or applied mathematics.
		4.2	Will be able to use modern mathematical methods for solving mathematical problems.
		4.3	Will be able to understand latest results and trends of knowledge in selected branch of mathematics.
5.	**Ability to apply mathematical knowledge and skills**	5.1	Will be able to create mathematical models of the analysis of real-world processes.
		5.2	Will be able to analyze the simulation results of the search for optimal solutions, assessing the adequacy and accuracy of the model, if needed to improve models.
6.	**Ability to perform mathematical research**	6.1	Will be able to conduct primary research literature searches in their chosen field of investigation.
		6.2	Will be able to use pure mathematical or applied methods to understand some aspect of the frontiers of mathematical knowledge.
		6.3	Will be able to select and use specific software for research or practical activity data needed for the synthesis, processing and analysis.
		6.4	Will be able to present mathematical results of the research and to described in the modern high-level mathematical language.

STUDY PROGRAMME TEMPLATE (COURSE UNITS RELATION TO COMPETENCES AND LEARNING OUTCOMES)

Code	Course units [link to unit description]	Credits	Student's workload	Contact hours	Self-study hours	Competencies													
						General competencies					Subject-specific competencies								
						1.		2.	3.		4.			5.		6.			
						Learning outcomes													
						1.1	1.2	2	3.1	3.1	4.1	4.2	4.3	5.1	5.2	6.1	6.2	6.3	6.4
1nd YEAR		**60**	**1560**	**448**	**1112**														
SEMESTER 1		**30**	**780**	**224**	**556**														
	Compulsory course units																		
MM112FA	Supplementary Chapters in Functional Analysis	10	260	64	196	X	X	X			X	X	X						X
MM111MW	Mathematical Writing at Higher Level	5	130	48	82	X		X	X			X							
MM111FS	Function Spaces	5	130	48	82	X	X				X	X	X						X
	Optional course units																		
MM110PC	Probabilistic Combinatorics	5	130	32	98	X	X				X	X	X	X					
MM110ANT	Analytic Number Theory	5	130	32	98	X		X			X	X	X			X			X
MM110IE	Integral Equations	5	130	32	98	X	X	X	X		X	X	X						
MM110NM	Numerical Methods for Differential Equations	5	130	32	98		X	X	X		X	X	X	X	X			X	
SEMESTER 2		**30**	**780**	**224**	**556**														
	Compulsory course units																		
MM122PDE	Partial Differential Equations	10	260	64	196	X	X	X	X		X	X		X					
MM121AA	Abstract Algebra	5	130	48	82	X			X	X	X								X
MM121PC	Parallel Computing	5	130	48	82	X		X	X	X		X			X			X	
	Optional course units																		
MM120SPT	Stochastic Processes Theory	5	130	32	98	X		X				X	X	X					X
MM120RM	Risk theory	5	130	32	98		X	X				X	X	X	X		X		
MM120VM	Variational Methods for Nonlinear Phenomenons	5	130	32	98		X	X	X		X			X	X	X			X
MM120MMF	Mathematics in Modern Finance	5	130	32	98		X	X		X		X	X		X				

2nd YEAR		**60**	**1560**	**416**	**1144**														
SEMESTER 3		**30**	**780**	**192**	**588**														
	Compulsory course units																		
MM232PTMS	Probability Theory and Mathematical Statistics	10	260	64	196	X	X				X	X		X	X			X	
MM231SP	Packages of Statistics	5	130	48	82				X	X					X			X	
MM230FSR1	Fundamentals of Scientific Research. Problems of Number	5	130	16	114	X	X		X						X	X			
MM230FSR2	Fundamentals of Scientific Research. Models of					X	X		X	X		X		X					
	Optional course units																		
MM230SDE	Stochastic Differential Equations	5	130	32	98		X	X			X	X	X	X					X
MM230WCM	Weak Convergence of Measures	5	130	32	98	X			X		X	X	X						X
MM230GT	Graph Theory	5	130	32	98			X				X		X	X			X	X
MM230DS	Dynamical Systems	5	130	32	98		X	X		X	X	X	X						
MM230NSE	Mathematical Theory of Navier-Stokes Equations	5	130	32	98	X	X			X	X	X							
MM230AM	Asymptotic Methods for Partial Differential equations	5	130	32	98	X	X		X			X		X					X
SEMESTER 4		**30**	**780**	**64**	**716**														
	Compulsory course units																		
MM240MTS1	Master's Thesis Seminar in Probability Theory and	25	650	32	618	X	X	X	X		X	X	X	X	X	X	X	X	X
MM240MTS2	Master's Thesis Seminar in Differential Equations	5	130	32	98	X	X		X						X	X			
MM240MTS2	Master's Thesis Seminar in Differential Equations					X	X		X						X	X			

Grey color marks units of study fields

Orange color marks master thesis preparation and defense marcs

2 from 4

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