A Description of Mathematics and Applications of Mathematics Degree Programme

Title of the degree programme	National code
Mathematics and Applications of Mathematics	612G10001

Official name of the awarding institution	Language(s) of instruction
Vilnius University Faculty of mathematics and informatics Department of probability theory and number theory Department of differential equations and numerical mathematics	Lithuanian/English

Kind of study	Cycle of studies	Level of qualification
University studies	1st cycle	Level VI

Mode of study and length of the programme in years)	Length of the degree programme in ECTS credits	Student's workload in hours	Contact hours	Autonomous work hours
Full-time, 4 years	240	6400	3252	3148

Study area	Study field	Study branch
Physical Sciences	Mathematics	-

Degree and/or qualification awarded
Bachelor of Mathematics

Programme director	Contact information
Prof. dr. Ramūnas Garunkštis	Faculty of mathematics and informatics Department of probability theory and number theory Naugarduko St. 24 LT-03225 Vilnius Lithuania e-mail: ramunas.garunkstis@mif.vu.lt Tel. +370 5 2193079

Accreditation organization(s)	Period of reference
Center for Quality Assessment in Higher Education	2017 12 31

Purpose of the programme
We aim at teaching the student different aspects of mathematics and to develop his or her critical thinking abilities. The programme focuses on pure mathematics, applied mathematics, and computer science. The student will get training in advanced mathematical techniques, problem solving, computer programming, and clear communication of his or her ideas to others, all of which are valued by potential employers. The student will become a specialist who is able to work in various areas requiring analytic thought. We expect the student to develop a longterm interest in mathematics and its applications.

Degree profile characteristics	
Discipline(s)/subject areas	**Distinctive features**
Study field subjects can be divided into the following groups: ● Pure mathematics: 75 credits ● Applications of mathematics: 35 credits ● Informatics: 10 credits ● Physics: 5 credits ● Foreign language: 10 credits ● Practice: 18 credits ● Bachelor's thesis: 12 credits	Good knowledge of mathematics is a universal skill, which can be applied in a variety of fields, such as finance, engineering, information technologies, science, or teaching. While there are mathematical programmes of various kinds in Lithuanian universities, our programme is the only one in the country which focuses on mathematics as such, not only on the ways to apply it. By doing so, we offer our students the distinctive university experience, which is to be a part of an institution emphasizing the importance of reflection.

Admission requirements	Specific arrangements for recognition of prior learning
Prospective students must have an upper secondary education. They also have to take an exam in mathematics, an exam in either information technologies or physics, and an exam in Lithuanian language and literature.	By the general rules of Vilnius University

Access to further studies
Upon graduation, students may continue studying mathematics or a related area, such as financial and actuarial mathematics, statistics, or computer science, for the Master's degree. Later on, they can enroll in PhD programme in mathematics or computer science.

Employability
The study programme *Mathematics and Applications of Mathematics* corresponds to the needs of the contemporary labor market. Its graduates can work in innovative high-tech, finance, consultancy, IT companies, industry, science and education institutions. Graduates can also pursue a career in spheres where their mathematical knowledge, abstract and analytical type of thinking and ability to use specialized software are needed.

Learning and teaching approaches	Assessment methods
Lectures, tutorials, problem solving, modeling, case studies, projects, individual reading, supervision, and mentoring.	The most common assessment method is the written final exam. In some courses, students have to take various kinds of tests during the semester, make oral presentations, work on projects, and develop software programs. Based on these, the students receive a certain amount of points. Upon completing the course, the students usually receive a grade in 10 point system. In some courses, the students are evaluated on a pass/fail basis.

Generic competences		Programme learning outcomes A student will be able to	
1.	Abstract and analytic thinking	**1.1**	analyze problems by reducing them to essentials, by considering counterexamples and boundary cases.
2.	Communication, collaboration, and social skills	**2.1**	communicate in Lithuanian and/or English language in subject-related situations.
		2.2	critically assess the outcomes of his or her own activities as well as that of others.
		2.3	present mathematical statements, their proofs, problems, and their solutions for both specialists and non-specialists in a clear and precise way.
		2.4	work individually and in a team.
3.	Lifelong learning skills	**3.1**	apply various strategies and methods of learning; find and analyze literature, collect data, process and analyze the information obtained.
Subject-specific competences		**Learning outcomes** **A student will be able to**	
4.	Comprehensive knowledge of mathematics	**4.1**	define and illustrate main concepts of mathematics, communicate in mathematical language.
		4.2	state and prove basic mathematical propositions.
		4.3	apply basic mathematical propositions to solve typical problems.
5.	Mathematical modeling	**5.1**	formulate real-world problems in mathematical language.
		5.2	construct mathematical models.
		5.3	make and justify conclusions (implications) based on the analysis of the relevant mathematical model.
6.	Application of computer software	**6.1**	use several programming languages.
		6.2	solve mathematical and non-mathematical problems by using computer software.

PLAN OF STUDIES (full time)
(COMPETENCES AND LEARNING OUTCOMES)

Course unit code	Academic disciplines	Credits	Student`s workload	Contact hours	Individual work		Programme competences												
							Generic competences					Subject specific competences							
						1.	2.				3.	4.			5.			6.	
												Programme learning outcomes							
						1.1	2.1	2.2	2.3	2.4	3.1	4.1	4.2	4.3	5.1	5.2	5.3	6.1	6.2
Year 1		**60**	**1600**	***904***	***696***														
Semester 1		**30**	**800**	***456***	***344***														
Compulsory subjects																			
	Analysis I	*8*	*220*	*144*	*76*	x			x			x	x	x	x				
	Linear algebra and geometry	*7*	*180*	*110*	*70*	x			x			x	x	x					
	Fundamentals of discrete mathematics	*5*	*140*	*72*	*68*	x			x			x	x	x	x	x			
	Informatics I	*5*	*130*	*66*	*64*						x			x				x	x
	Foreign language I	*5*	*130*	*64*	*66*		x	x		x	x								
Semester 2		**30**	***800***	***448***	***352***														
Compulsory subjects																			
	Analysis II	*8*	*220*	*144*	*76*	x			x			x	x	x	x				
	Algebra I	*7*	*180*	*110*	*70*	x			x			x	x	x					
	Informatics II	*5*	*140*	*66*	*74*						x			x				x	x
	Foreign language II	*5*	*130*	*64*	*66*		x	x		x	x								
Elective subjects																			
	General elective subject	*5*	*130*	*64*	*66*														
Year 2		**60**	**1600**	***952***	***648***														
Semester 3		**29**	**770**	***469***	***301***														

Compulsory subjects																			
	Analysis III	***8***	***220***	*144*	*76*	x			x			x	x	x	x	x			
	Algebra II	*6*	*160*	*110*	*50*	x			x			x	x	x					
	Differential equations I	*5*	*130*	*68*	*62*	x			x			x	x	x	x	x	x		
	Geometry	*5*	*130*	*75*	*55*	x			x			x	x	x					
*	*Combinatorics and graph theory*	*5*	*130*	*72*	*58*	x			x			x	x	x	x				
Semester 4		**31**	***830***	***483***	***347***														
Compulsory subjects																			
	Differential equations II	*5*	*130*	***68***	***62***	x			x			x	x	x	x	x	x		x
	Probability theory and mathematical statistics I	*6*	*150*	***92***	***58***	x			x			x	x	x	x	x	x		
	Complex analysis	*6*	*170*	***108***	***62***	x			x			x	x	x					
	Measure and integral theory	*5*	*130*	***75***	***55***	x			x			x	x	x					
	Numerical analysis I	*4*	*120*	***70***	***50***	x			x			x	x	x	x	x		x	
	Database management systems	*5*	*130*	***70***	***60***						x			x				x	x
Year 3		**60**	**1600**	***938***	***662***														
Semester 5		**30**	**800**	***478***	***322***														
Compulsory subjects																			
	Probability theory and mathematical statistics II	***5***	*130*	*94*	*36*	x			x			x	x	x	x	x	x		
	Functional analysis	*6*	*160*	*106*	*54*	x			x			x	x	x					
	Mechanics	*4*	*120*	*72*	*48*	x			x					x	x	x	x		
Elective subjects																			
*	*History and philosophy of mathematics*	*5*	*130*	*52*	*78*		x	x		x	x	x							
*	*Numerical analysis II*	*5*	*130*	*72*	*58*	x			x			x	x	x	x	x		x	
*	*Selected topics of complex analysis*	*5*	*130*	*74*	*56*	x			x			x	x	x					

*	*Java technologies*	*5*	*130*	*70*	*60*					x	x			x				x	x
*	*Visual programming*	*5*	*130*	*52*	*78*						x							x	x
*	*Internet technologies*	*5*	*130*	*52*	*78*					x	x			x				x	x
	General elective subject	*5*	*130*	*64*	*66*														
Semester 6		**30**	**800**	***460***	***340***														
Compulsory subjects																			
*	*Number theory*	*5*	*130*	*72*	*58*	x			x			x	x	x					
	Equations of mathematical physics	*6*	*160*	*92*	*68*	x			x			x	x	x	x	x			
*	*Applied statistics*	*5*	*130*	*70*	*60*	x									x	x			x
	Physics	*4*	*120*	*78*	*42*	x					x				x	x	x		
Elective subjects																			
*	*Selected topics in analysis*	*5*	*102*	*70*	*32*	x			x		x	x	x	x	x	x	x		
*	*Basics of operator theory*	*5*	*130*	*74*	*56*	x			x			x	x	x					
*	*Introduction to Galois theory*	*5*	*130*	*76*	*54*	x			x			x	x	x					
*	*Harmonic analysis*	*5*	*130*	*72*	*58*	x			x			x	x	x					
*	*Introduction to algebraic number theory*	*5*	*130*	76	*54*	x			x			x	x	x					
*	*Variational calculus and optimal control*	*5*	*130*	*74*	*56*	x			x			x	x	x	x	x	x		
*	*Selected topics in combinatorics*	*5*	*130*	*72*	*58*	x						x	x	x	x	x	x		x
Year 4		**60**	**1600**	***458***	***1142***														
Semester 7		**30**	**800**	***424***	***376***														
Compulsory subjects																			
*	*Basics of mathematical modelling*	*5*	*140*	*70*	*70*	x			x						x	x	x		
*	*Reliability theory*	*5*	*140*	*74*	*66*	x			x			x	x	x	x				
Elective subjects																			
*	*Information theory and data*	*5*	*130*	*70*	*60*						x				x				

	mining																		
*	*Mathematics of financial markets*	*5*	*130*	*70*	*60*	x									x	x	x		
*	*Encoding and cryptography*	*5*	*130*	*72*	*58*						x	x	x	x	x				x
*	*Asymptotic methods of differential equations*	*5*	*130*	*74*	*56*	x			x			x	x	x	x	x			
*	*Algorithmic number theory*	*5*	*130*	*76*	*54*	x			x			x	x	x					x
	General elective subject	*5*	*130*	*64*	*66*														
Semester 8		**30**	**800**	***34***	***766***														
Compulsory subjects																			
	Graduating work	*12*	*350*	*16*	*334*	x	x		x		x	x	x	x	x	x	x	x	x
	Professional practice	*18*	*450*	*18*	*432*		x	x		x	x			x	x	x	x	x	x