COURSE UNIT DESCRIPTION

Course unit title	Code
Function Spaces	**MM111FS**

Lecturer(s)	Department(s) where the course unit is delivered
Coordinator: prof. Artūras Štikonas **Other(s):**	**Faculty of Mathematics and Informatics** **Naugarduko St. 24, LT-03225 Vilnius, Lithuania**

Study cycle	Type of the course unit
second	**Compulsory**

Mode of delivery	Period when the course unit is delivered	Language(s) of instruction
face-to-face	**1st year, semester 1**	**Lithuanian, English**

Requirements for students	
Prerequisites: none	**Additional requirements (if any):** none

Course volume in credits	Total student's workload	Contact hours	Self-study hours
5	**130**	**48**	**82**

Purpose of the course unit: programme competences to be developed		
The aim of the course is to increase knowledge of mathematical theory and problem solving techniques related to function spaces.		
Learning outcomes of the course unit	**Teaching and learning methods**	**Assessment methods**
Understand the concepts, methods and structure of theory of Sobolev spaces.	Lecture, individual reading	Midterm exam (written), Exam (written)
Formulate (verbally or in text) ideas, propositions and proofs related to the subject using the appropriate language.	Lecture, individual reading	
Solve mathematical problems using techniques from the theory of function spaces.	Lecture, problem solving	
Select and adapt mathematical techniques of asymptotic methods for PDEs to solve real-world problems, critically evaluate obtained results.	Individual reading, problem solving	

Content: breakdown of the topics	Contact hours	Self-study work: time and assignments

	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work	**Contact hours**	**Self-study hours**	**Assignments**
1. Mollifiers and their properties. Compactness criteria. Generalized derivatives and their properties. Absolutely continuous functions. Sobolev spaces and extensions of their elements.	10						**10**	**16**	Studying and problem solving [1. §2.1-2.7]
2. Integral operators with singular kernels. Integral representation of functions from Sobolev spaces. Embedding theorems.	10						**10**	**16**	Studying [1. §3.1-3.4] and problem solving [1. §3.9]
3. Equivalent norms in Sobolev spaces. Interpolation inequalities.	10						**10**	**16**	Studying [1. §3.5-3.6] and problem solving [1. §3.9]
4. Sobolev spaces $W_p^k(R^n)$ for positive values of *k*. Traces. Other function spaces.	10						**10**	**16**	Studying and problem solving [1. §3.7-3.9]
5. Exam.		4	4				**8**	**18**	Preparation for the exam
Total	**40**	**4**	**4**				**48**	**82**	

Assessment strategy	**Weight,%**	**Deadline**	**Assessment criteria**
Midterm exam	50	During a semester	Midterm exam consists of 2 theoretical questions and 3 exercises (Part I of the course material), 2 points for each question. Midterm exam is evaluated in the ten point system. Correct solution or formulation for theoretical question, respectively, is evaluated by 2 points. One point for a solution with minor mistakes and 0 points for incorrect or missing solution.
Exam	50	At the end of a semester	Exam consists of 2 theoretical questions and 3 exercises (Part I of the course material), 2 points for each question. Exam is evaluated in the ten point system. Correct solution or formulation for theoretical question, respectively, is evaluated by 2 points. One point for a solution with minor mistakes and 0 points for incorrect or missing solution.

Author	**Year of publication**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsary reading				
1. L.C. Evans	1999	Partial Differential Equations		American Mathematical Society
2.A.Ambrazevičius, A.Domarkas	1999	Equations of Mathematical Physics 2		Vilnius, „Aldorija“
Optional reading				
3. R. Adams, J. Fournier	2007	Sobolev Spaces		Elsevier: Pure and Applied Mathematics