



Subject card

Subject name and code	Sobolev space, PG_00021516						
Field of study	Mathematics						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Robert Krawczyk				
	Teachers		dr inż. Robert Krawczyk				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	15.0	60
	E-learning hours included: 0.0						
	Additional information: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=37851						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		5.0		35.0	100
Subject objectives	The aim of the subject is to present basic properties of Sobolev spaces of functions from an interval to the real line and basic theorems on minimization of integral functionals in Sobolev spaces.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
Subject contents	Basic functional spaces: continuous functions, absolutely continuous functions, p-integrable functions, essentially bounded functions. The Sobolev spaces - a definition and basic properties. Convergence and weakly convergence in the Sobolev spaces. Embedding lemmas. Minimization of integral functionals in the Sobolev spaces.						
Prerequisites and co-requisites	Functional analysis I.						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	A math test		50.0%		50.0%		
	Project on a given subject. Project's presentation on the seminar.		75.0%		50.0%		
Recommended reading	Basic literature		1. Joanna Janczewska, Minimization of integral functionals in Sobolev spaces, Lecture Notes in Nonlinear Analysis, Juliusz Schauder Center for Nonlinear Studies, vol. 12, 2011, p. 61-91.				
	Supplementary literature		1. Robert A. Adams, John J.F. Fournier, Sobolev Spaces, Pure and Applied Mathematics, 140, Elsevier, 2009. 2. Giovanni Leoni, A First Course in Sobolev Spaces, Graduate Studies in Mathematics, 105, Amer. Math. Soc., 2009.				
	eResources addresses		Podstawowe https://enauczanie.pg.edu.pl/moodle/course/view.php?id=37851 - Uzupełniające Adresy na platformie eNauczanie:				

<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> 1. Is $\{u_n\}$ a Cauchy sequence in $W^{1,p}[a,b]$? 2. Is $\{u_n\}$ convergent (weakly convergent) in $W^{1,p}[a,b]$? 3. Show please that a given functional $l:W^{1,p}[a,b] \rightarrow \mathbb{R}$ is linear and continuous. 4. Give please basic properties of the Sobolev spaces $W^{1,p}[a,b]$ ($p \geq 1$) and $W^{1,1}[a,b]$. 5. Show please that a given function $f:[a,b] \rightarrow \mathbb{R}$ is absolutely continuous. 6. Prove please that any absolutely continuous function $f:[a,b] \rightarrow \mathbb{R}$ has a bounded variation.
<p>Work placement</p>	<p>Not applicable</p>

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