GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Sobolev space, PG_00021516		
Field of study	Mathematics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
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	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Probability Theory and Biomathematics -> 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						

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
K7_W03	A student knows theorems on representation of linear continuous functionals in selected Sobolev spaces.	[SW1] Assessment of factual knowledge
K7_W01	A student knows definitions and basic properties of the Sobolev spaces.	[SW1] Assessment of factual knowledge
K7_U06	A student is able to examine the convergence and the weak convergence of sequences in Sobolev spaces.	[SU1] Assessment of task fulfilment
K7_K02	A student can ask questions and formulate problems within the subject.	[SK4] Assessment of communication skills, including language correctness
K7_W02	A student knows a few embedding lemmas and can apply them. A student can give examples of problems on minimization of integral functionals in Sobolev spaces and understands their relation with suitable diffrential equations.	[SW1] Assessment of factual knowledge

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 presentetion 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	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	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 $I:W^{1,p}[a,b]\to R$ is linear and continuous. 4. Give please basic properties of the Sobolev spaces $W^{1,p}[a,b]$ $(p\geq 1)$ and $W^{1,\infty}[a,b]$. 5. Show please that a given function $f:[a,b]\to R$ is absolutely continuous. 6. Prove please that any absolutely continuous function $f:[a,b]\to R$ has a bounded variation.		
Work placement	Not applicable		