GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical Analysis, PG_00021503		
Field of study	Mathematics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	10.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Nonlinear Analysis and Statistics -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Styborski	
	Teachers	dr inż. Magdalena Chmara mgr inż. Urszula Goławska dr inż. Marcin Styborski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	60.0	60.0	0.0	0.0	0.0	120
	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	120	5.0	125.0	250

Subject objectives	The aim of the course is to familiarize students with the basics (definitions, theorems, methods of calculation and problem-solving methods) of integral calculus of functions of several variables and its applications in field theory, physical and technical issues.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W07	The student can justify the importance of the Jacobian of functions of many variables and what role it plays in the change of variables theorem in multiple integrals.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K6_W04	After the course, the student will be familiar with the classical theorems that generalize the Newton-Leibniz formula to higher dimensions, i.e. Green, Gauss and Stokes. The student will be able to apply these theorems.	[SW1] Assessment of factual knowledge
K6_U02	The student is able to carry out formal reasoning leading to the justification of the theorems of Fubini, Green and Stokes.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
K6_U04	The student knows the definition and examples of curves and surfaces. The student is able to calculate their lengths and areas appropriately. Knows the concept of multidimensional volume.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
K6_U06	The student is able to define the integral of a function of many variables, is able to convert the integral of such a function into an iterated integral and perform calculations in appropriately selected examples. It also defines line and surface integrals. Is able to use Green, Gauss and Stokes theorems.	[SU3] Assessment of ability to use knowledge gained from the subject

Subject contents

Riemann integral in n-dimensional space. Fubini theorem and iterated integrals. Sets of measure zero and volume zero, the integral over a measurable set. Lebesgue integrability criterion in the sense of Riemann. Normal regions and their properties. Change of variables in multiple integrals . Curvilinear integrals. Green theorem and its applications. Surface integrals. Gauss - Ostrogradsky theorem. Stokes theorem. Elements of field theory: a divergence and rotation of a vector field. Gradient fields. Applications of curvilinear, multiple and surface integrals in physics and engineering. Introduction to the theory of Lebesgue measure and integration.

Prerequisites and co-requisites

Knowledge of previous courses of mathematical analysis (analysis I and analysis II: calculus of functions of several variables, integral calculus of functions of one variable)

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
an exam	50.0%	50.0%
a completion of the exercises	50.0%	50.0%

Recommended reading

Basic literature	W. Rudin, "*Principles of Mathematical Analysis,*" PWN, Warsaw 2009. G. Fichtencholz, "*Differential and integral calculus",* PWN, Warsaw 1976.
Supplementary literature	M. Spivak, "*Calculus on manifolds*", PWN, Warsaw 1977.
eResources addresses	Adresy na platformie eNauczanie: Analiza matematyczna III - 2023/2024 - Moodle ID: 30886 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30886

Example issues/ example questions/ tasks being completed

Calculate a double/ triple/ path/ surface integral.

Apply the theorem of Green/ Gauss/ Stokes.

Work placement

Not applicable

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