GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mathematical Analysis, PG_00021503		
Field of study	Analiza matematyczna		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
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	Divison of Nonlinear Analysis -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marcin Styborski	
	Teachers	dr inż. Robert Krawczyk dr inż. Marcin Styborski	

Lesson types

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

eNauczanie source addresses:

Moodle ID: 47143 Analiza matematyczna III, rok akademicki 2025/26
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=47143

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_U02	The student is able to carry out formal reasoning leading to justification of theorems on inversion of a mapping, on implicit functions and the theorems of Fubini, Green, Gauss and Stokes.	[SU1] Ocena realizacji zadania [SU2] Ocena umiejętności analizy informacji
K6_W04	After completing this course, students will be familiar with classical theorems that generalize the Newton-Leibniz formula to higher dimensions, such as Green's, Gaussian, and Stokes'. They will be able to apply these theorems.	[SW1] Ocena wiedzy faktograficznej
K6_U04	Students know the definitions and examples of curves and surfaces. They can calculate their lengths and areas, respectively. They are familiar with the concept of multidimensional volume.	[SU2] Ocena umiejętności analizy informacji [SU4] Ocena umiejętności korzystania z metod i narzędzi
K6_W07	The student is able to justify the importance of the Jacobian of a function of several variables and what role it plays in the theorem on the change of variables in a multiple integral.	[SW1] Ocena wiedzy faktograficznej [SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym
K6_U06	Students can define the integral of a function of several variables, convert the integral of such a function to an iterated integral, and perform calculations using appropriately selected examples. They also define line and surface integrals. They can use Green's, Gauss', and Stokes' theorems.	[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu

Subject contents

Local invertibility of maps, implicit maps. Extrema on surfaces with equation g(x)=0, method of Lagrange multipliers. 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.

During the exercises, students and their teacher will discuss the lecture content and perform appropriate calculation exercises illustrating the theoretical material being covered.

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
a completion of the exercises	51.0%	64.0%
an exam	51.0%	36.0%

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	

Example issues/ example questions/ tasks being completed

- Prove that a given transformation is locally invertible. Calculate the derivative of the inverse mapping
- Prove that a given equation generates a locally implicit mapping. Calculate the derivative of this map at a given point.
- Calculate a double/ triple/ path/ surface integral.
- Apply the theorem of Green/ Gauss/ Stokes.

Practical activites within the subject

Not applicable