



Subject card

Subject name and code	Mathematical analysis II, PG_00072271						
Field of study	Technical Physics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			6.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Divison of Dynamical Systems -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr Joanna Cyman					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	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		85.0	150
Subject objectives	To provide students with the knowledge and skills necessary for the mathematical analysis of functions of one and several variables, essential for describing and modeling physical phenomena. To develop skills in applying differential and integral calculus methods to solve mathematical, physical, and technical problems, and to develop analytical thinking and independent problem-solving skills.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U02] is able to analyse and solve complex and non-standard scientific and technical problems using appropriate analytical, computational, numerical, simulation or experimental methods.	The student is able to analyse and solve mathematical and physical problems using methods of differential and integral calculus of functions of one and several variables. The student applies appropriate analytical methods to compute definite, improper, and multiple integrals. The student determines partial derivatives, directional derivatives, and derivatives of implicit functions, and applies them to investigate properties of functions of several variables and determine their extrema. The student is able to use methods of mathematical analysis to describe and solve selected geometric and physical problems.	[SU4] Assessment of ability to use methods and tools
	[K6_U01] demonstrates the ability for lifelong independent learning, including acquiring information from literature, databases and other appropriate sources.	The student is able to independently expand their knowledge of mathematical analysis and use literature and other sources to solve mathematical and physical problems.	[SU2] Assessment of ability to analyse information
	[K6_W03] possesses structured knowledge of higher mathematics, including algebra, analysis, probability and numerical methods, sufficient to describe, understand and model complex physical phenomena and selected technical processes.	The student is familiar with the basic concepts and theorems of mathematical analysis and their role in describing and modelling physical phenomena. The student has knowledge of definite and improper integrals together with their geometric and physical interpretations. The student knows the properties of functions of several variables, including limits, continuity, and differentiability. The student has knowledge of partial and directional derivatives, higher-order derivatives, and derivatives of implicit functions. The student is familiar with the concept of extrema of functions of several variables and multiple integrals together with their geometric and physical interpretations.	[SW1] Assessment of factual knowledge

Subject contents	<p>Course content – lecture Integral calculus of a function of a single variable. The Riemann definite integral and its geometric and physical applications. Improper integrals.</p> <p>Numerical series. The integral test for the convergence of numerical series.</p> <p>Differential calculus of functions of multiple variables. Functions of multiple variables, their limits, and continuity. First-order partial derivatives and the total differential. Directional derivative. Higher-order derivatives and differentials. Derivative of a composite function. Implicit functions. Extrema of functions of multiple variables.</p> <p>Integral calculus of functions of multiple variables. Double and triple integrals. The theorem on the change of variables in multiple integrals. Geometric and physical applications of multiple integrals.</p> <hr/> <p>Course content – exercises Tutorial classes (problem-solving exercises) covering topics discussed in lectures.</p> <p>Integral calculus of functions of one variable: computation of definite integrals using analytical methods, geometric and physical applications of definite integrals (area of a plane region, arc length, volume of solids of revolution, work, mass, center of mass). Improper integrals and the study of their convergence.</p> <p>Infinite series: investigation of the convergence of numerical series using the integral test.</p> <p>Differential calculus of functions of several variables: determination of limits and investigation of continuity of multivariable functions. Computation of partial derivatives, directional derivatives, and total differentials. Higher-order derivatives, including derivatives of implicit functions. Determination of local and constrained extrema of functions of several variables. Determination of global extrema on closed domains.</p> <p>Integral calculus of functions of several variables: computation of double and triple integrals, and change of variables in multiple integrals. Geometric and physical applications of multiple integrals, in particular computation of areas, volumes, and mass.</p>																	
Prerequisites and co-requisites	The student has knowledge of differential and integral calculus of functions of one variable and is able to perform basic computations in this area.																	
Assessment methods and criteria	<table border="1" data-bbox="450 1187 1489 1361"> <thead> <tr> <th data-bbox="450 1187 794 1220">Subject passing criteria</th> <th data-bbox="794 1187 1141 1220">Passing threshold</th> <th data-bbox="1141 1187 1489 1220">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="450 1220 794 1254">Colloquium 1</td> <td data-bbox="794 1220 1141 1254">0.0%</td> <td data-bbox="1141 1220 1489 1254">27.0%</td> </tr> <tr> <td data-bbox="450 1254 794 1288">Colloquium 2</td> <td data-bbox="794 1254 1141 1288">0.0%</td> <td data-bbox="1141 1254 1489 1288">27.0%</td> </tr> <tr> <td data-bbox="450 1288 794 1321">Activity</td> <td data-bbox="794 1288 1141 1321">0.0%</td> <td data-bbox="1141 1288 1489 1321">6.0%</td> </tr> <tr> <td data-bbox="450 1321 794 1361">Exam</td> <td data-bbox="794 1321 1141 1361">50.0%</td> <td data-bbox="1141 1321 1489 1361">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Colloquium 1	0.0%	27.0%	Colloquium 2	0.0%	27.0%	Activity	0.0%	6.0%	Exam	50.0%	40.0%
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<p>Example issues/ example questions/ tasks being completed</p>	<p>Find all local extrema of the function of two variables: $f(x,y)=(x-y+1)^2+(2x+y-4)^2$.</p> <p>Using polar coordinates, evaluate the given integral: $\iint_D \frac{y}{x} dx dy$, gdzie D : $x^2+y^2 \leq 1, 0 \leq y \leq x, x \geq 0, y \geq 0$.</p>
<p>Practical activities within the subject</p>	<p>Not applicable</p>

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