University of Gdańsk

Subject card

Subject name and code	Mathematical Methods in Oceanography - laboratory, PG_00206209		
Field of study	Oceanography		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional 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	1	ECTS credits	3.0
Learning profile	academic	Assessment form	credit
Conducting unit	Division of Mathematical Methods of Physics -> Institute of Theoretical Physics and Astrophysics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Krzysztof Szczygielski	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	45.0	0.0	0.0	45
	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	45	2.0	28.0	75

Subject objectives	Students will became proficient in matrix algebra and index notation; will be introduced to vector calculus in curvilinear coordinates; will be able to calculate Fourier transforms and solve most frequent types of differential equations, using relevant software.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[OCEANMU2-K03] is ready to effectively organize his/her own work, is active and persistent and punctuality in completing tasks, is ready to carrying out evaluation of their own activities	is ready to effectively organize his/her own work while applying mathematical methods, is active and persistent and punctual in completing tasks, is ready to evaluate their own activities	[SK4] test/exam - oral or written [SK5] implementation of a problem task
[OCEANMU2-W01] knows and understands in-depth specialized terminology used in oceanography and related sciences (in Polish and a selected foreign language)	knows and understands in-depth specialized, mathematical terminology used while applying mathematical methods to solve oceanographical problems (in Polish and a English	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[OCEANMU2-W03] has an in-depth understanding of research methods used in oceanography and related sciences, and interprets their mechanisms and interrelationships across different spatial and temporal scales	knows and understands, in-depth, mathematical methods and techniques used in oceanography	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[OCEANMU2-U06] is able to use specialized computer software as well as advanced mathematical and statistical methods to analyze data and describe processes and phenomena occurring in the marine and coastal environment; evaluates their reliability and usefulness and performs critical analysis	can use advanced mathematical methods in data analysis and modelling of processes and phenomena occurring in the marine environment and coastal zone	[SU4] test/exam - oral or written [SU5] implementation of a problem task

Subject contents

A series of problems solved with analytical techniques and symbolic calculations on:

- selected topics in linear algebra; index notation;
- vector field analysis and volume, calculation of surface and line integrals, integral theorems applications;
- curvilinear coordinate systems and application of differential operators in curvilinear coordinate systems;
- introductory aspects of tensor analysis;
- the Fourier transform;
- solving selected types of ordinary and partial differential equations.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
in-class discussions	51.0%	10.0%
final written test	51.0%	70.0%
in-class assignments	51.0%	20.0%

Recommended reading

Basic literature	• Karaśkiewicz E., 1974. An Outline of Vector and Tensor Theory, PWN (in Polish) • Byron F.W., Fuller R.W., 1975. Mathematics in classical and quantum physics, tom 1, PWN (in Polish) • Sirovich L., 1998, Introduction to applied mathematics, Springer-Verlag • Cohen M., 2024. Practical Linear Algebra for Data Science. From Core Concepts to Applications Using Python. Helion (in Polish)
Supplementary literature	• Arfken, G.B., Weber H.J., Harris F.E., 2012. Mathematical methods for Physicists: A comprehensive guide (selected chapters) • Strzelecki, 2006, A short introduction to differential equations, University of Warsaw Press (in Polish) Wydawnictwo Uniw. Warszawskiego (or alternative) • Boelkins M.R, Goldberg J.L., Potter M., 2009, Differential Equations with Linear Algebra, Oxford University Press • Aris R., 1989. Vectors, tensors and the basic equations of fluid mechanics. Dover Publ. (chapters 1-4; very condensed, heavy and generally not suitable as a first read, but a good indication of topics needed in cartesian tensors)
eResources addresses	

Example issues/ example questions/ tasks being completed

calculate the surface integral

calculate the Fourier transform of a given function

Work placement	Not applicable

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