University of Gdańsk

Subject card

Subject name and code	Mathematical Methods in Oceanography - lecture, PG_00201908		
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	exam
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 hab. Marcin Marciniak	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	45.0	0.0	0.0	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-K04] is ready to critically evaluate his/her knowledge and received content in the field of natural sciences in in particular in the field of the studied specialty, a in problematic situations, supports oneself with knowledge experts	is ready to critically evaluate his/ her knowledge and received content in mathematical methods used in oceanography and seeks expert support when necessary	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written
[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
[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
[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

Subject contents

- Selected topics in linear algebra; index notation,
- Vector field analysis and volume, surface and line integrals, integral theorems,
- Curvilinear coordinate systems and differential operators in curvilinear coordinate systems,
- A practical introduction to tensor analysis;
- The Fourier transform;
- Selected topics in 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 examination	51.0%	90.0%

Recommended reading

Basic literature	• Karaśkiewicz E., An Outline of Vector and Tensor Theory, PWN 1974 (in Polish) • Byron F.W., Fuller R.W., Mathematics in classical and quantum physics, tom 1, PWN 1975 (in Polish) • Sirovich L., 1998, Introduction to applied mathematics, Springer-Verlag
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

1. Define and calculate the Fourier Transform of a given function.
2. State the Ostrogadski-Gauss Theorem and describe its applications.
3. Define and calculate divergence of a given cartesian tensor.

Work placement

Not applicable

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