University of Gdańsk

Subject card

Subject name and code	Waves and Dynamics of Coastal Waters - laboratory, PG_00206216		
Field of study	Oceanography		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional subject group 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	4.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Physical Oceanography -> Department of Physical Oceanography and Climate Research -> Faculty of Oceanography and Geography -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Jordan Badur	
	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	5.0	50.0	100

Subject objectives	Acquiring in-depth knowledge and understanding of selected aspects of dynamics of coastal seas, waters and coastal zone as well as the ability to solve associated problems, using mathematical techniques and 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 solving problems related to the dynamics of coastal seas, waters and coastal zone; 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-U01] is able to formulate and solve complex and unusual problems regarding the functioning of individual components of the marine environment using knowledge from various fields and scientific disciplines and propose solutions	is able to formulate and solve complex and unusual problems regarding the dynamics of coastal waters using relevant mathematical techniques and software.	[SU4] test/exam - oral or written [SU5] implementation of a problem task
[OCEANMU2-W02] knows and understands complex processes and phenomena occurring in the marine environment, with particular emphasis on the coastal zone, as well as complex relationships between living and non-living elements of the aquatic environment	knows and understands, in-depth, complex dynamical processes and phenomena occurring in the coastal seas and waters as well as complex relationships between hydrodynamics and the marine life	[SW4] test/exam - oral or written [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 mathematical methods of fluid mechanics and relevant software to analyse data and solve problems related to the dynamics of coastal seas, waters and coastal zone.	[SU4] test/exam - oral or written [SU5] implementation of a problem task

Subject contents

A number of analytical and computational problems will be solved in addition to performing selected derivations and the use of relevant software to gain further, in-depth, insight into:

1. Flows and boundary layers in coastal seas.
2. Long waves in coastal seas: Trapped waves; the influence of bathymetry and stratification.
3. Tides in coastal seas: Interaction with bathymetry; generation, mixing and tidal fronts; internal tides.
4. Fresh water outflows: Estuaries, fronts, buoyancy-driven currents, and wind-forced currents.
5. Wind waves: Linear theory of infinitesimal-amplitude waves over a flat seabed;. Energy flux and energy balance; wave action. Wave transformation processes: diffraction, refraction, and refraction in the presence of currents.
6. Small- and finite-amplitude waves.
7. Wave breaking processes and the surf zone.
8. Sediment transport processes and seabed morphodynamics;
9. An outline of wave-induced loads and interactions with engineering structures.
10. Statistical description of wind waves: Wind-wave spectra and methods for wind-wave forecasting.

Prerequisites and co-requisites

Passing grade in "Mathematical methods in oceanography", "Introduction to geophysical fluid mechanics" and "Programming and data analysis" OR the ability to demonstrate working knowledge of incompressible fluid mechanics, associated mathematical techniques and programming proficiency in the language used in the laboratory.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
In-class assignments	51.0%	20.0%
final written examination	51.0%	80.0%

Recommended reading

Basic literature

- Nielsen P., 2009. Coastal and Estuarine Processes, World Scientific Publishing, Singapore.
- Crapper G.D., 1984. Introduction to water waves, Ellis Horwood Ltd., Chichester. (wybrane rozdziały)
- Lisicki, 1996. Pływy na morzach i oceanach, Gdańskie Wydawnictwo Naukowe, Gdańsk
- Massel S.R. 2010. Procesy hydrodynamiczne w ekosystemach morskich. Wyd. Uniwersytetu Gdańskiego, Gdańsk. (topic 10, chapters: 11, 16)

	Supplementary literature	• Brink, K., 2009 Physical Oceanography of Continental Shelves, Princeton University Press. (further reading into advanced aspects of shelf seas dynamics) • Dean R. G., Darlymple R. A., 2019 (1991). Water wave mechanics for engineers and scientists, World Scientific Publishing, Singapore. • Holthuijsen, L. 2007. Waves in oceanic and coastal waters, Cambridge Univ. Press, Cambridge. • Pruszak, 1998. Dynamika brzegu i dna morskiego, IBW PAN, Gdańsk. • Bosboom J., Stive M.J.F, 2023. Coastal Dynamics, TU Delft Open, Delft, https://books.open.tudelft.nl/home/catalog/view/202/375/616 (introductory text) • Simpson, J.H., Sharples, J., 2012. Introduction to Physical and Biological Oceanography of Shelf Seas, Cambridge Univ. Press (further reading into interactions of marine dynamics and life - topic 10)
	eResources addresses	
Example issues/ example questions/ tasks being completed	Describe the wave shoaling effect Explain and apply the harmonic tidal prediction method Derive a formula for free surface elevation of a standing wave in a channel with linearly decreasing water depth and constant width.	
Work placement	Not applicable	

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