University of Gdańsk

Subject card

Subject name and code	Waves and Dynamics of Coastal Waters - lecture, PG_00201934		
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	2.0
Learning profile	academic	Assessment form	exam
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	30.0	0.0	0.0	0.0	0.0	30

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	30	2.0	18.0	50

Subject objectives	Acquiring in-depth knowledge and understanding of selected aspects of dynamics of coastal seas, waters and coastal zone.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[OCEANMU2-W06] knows and identifies potential threats to the marine environment on a local and global scale resulting from strong anthropopressure, predicts their effects on various time and space scales	knows and identifies potential threats to the marine environment resulting from coastal engineering constructions	[SW4] test/exam - oral or written
[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 the dynamics of coastal seas and waters and seeks expert support when necessary	[SK4] test/exam - oral or written
[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
[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
[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 terminology used in the dynamics of coastal waters (in Polish and English)	[SW4] test/exam - oral or written

Subject contents

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" and "Introduction to geophysical fluid mechanics" OR the ability to demonstrate working knowledge of incompressible fluid mechanics and associated mathematical techniques.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
final written examination	51.0%	100.0%

Recommended reading

Basic literature

- Nielsen P., 2009. Coastal and Estuarine Processes, World Scientific Publishing, Singapore. (selected chapters)
- Crapper G.D., 1984. Introduction to water waves, Ellis Horwood Ltd., Chichester. (selected chapters)
- 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 some advanced topics on shelf sea 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, a possible alternative to Nielsen's book) • Simpson, J.H., Sharples, J., 2012. Introduction to Physical and Biological Oceanography of Shelf Seas, Cambridge Univ. Press (further reading into relations between marine hydrodynamics and marine life - topic 10)
	eResources addresses	
Example issues/ example questions/ tasks being completed	Describe the processes leading to tidal front creation. Describe the wave action conservation.	
Work placement	Not applicable	

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