GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00072912		
Field of study	Civil Engineering		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Optional subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish No comments
Semester of study	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Waldemar Magda	
	Teachers	dr inż. Witold Sterpejkowicz-Wersocki	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	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	3.0	17.0	50

Subject objectives	
	Deepening knowledge regarding the principles of design and safety assessment of inland hydrotechnical structures (with particular emphasis on earth dams and spillway facilities) and offshore hydrotechnical structures (gravity breakwaters, offshore wind farms, offshore platforms, submarine pipelines). Developing the ability to select structural solutions, perform fundamental geotechnical and hydraulic calculations, and evaluate the stability, seepage, and operational conditions of the designed inland facilities. Preparation for conducting calculations related to the issues of hydrodynamic loads resulting from sea waves, as well as thermodynamic issues important for the proper functioning of offshore structures.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U02] interprets, in an in-depth way, phenomena and relationships between processes in the construction industry, using modern knowledge in line with the main trends in the development of scientific disciplines related to the field of study	A student interprets the relationships between geotechnical conditions, water filtration, the stability of earth dams, and the functioning of spillway structures. A student i nterprets the relationships between wave and thermal conditions affecting the load nature and the way of operation of marine hydrotechnical structures.	[SU2] Assessment of ability to analyse information
	[K7_W04] analyses in-depth complex problems on the basis of reliable data and appropriately chosen methods, reaching logical conclusions	A student analyses design issues related to earth dams and spillway structures, port and offshore structures, selecting appropriate data and calculation methods, and formulating well-founded conclusions.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K7_W01] identifies in-depth the phenomena related to the field of study and the theories describing them, indicating reliable sources of knowledge and information relevant to the issues analysed	A student identifies and explains phenomena relevant to the design and safety of inland hydraulic structures, as well as port and offshore hydrotechnical structures, using current technical knowledge, standards, and reliable literature sources.	[SW1] Assessment of factual knowledge
	[K7_U03] uses, to a deeper extent, appropriately selected analytical, numerical and experimental tools and methods to carry out tasks in the construction industry	A student uses analytical methods and computational tools to determine the basic geometric parameters of earth dams, assesses their stability, and calculates the discharge capacity of spillway structures. For given geometric conditions and type of structure, a student uses analytical methods and computational tools to determine hydrodynamic and thermodynamic loads leading to the assessment of the stability/strength of marine hydrotechnical structures.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents

Course content – lecture

Inland part:

1. Structural design of earth dams – dam types, embankment zones, seepage control measures, drainage systems, and protective elements.
2. Fundamentals of geotechnical design – selection of soil parameters, analysis of seepage through the embankment and foundation, and assesment of slope stability under typical design scenarios.
3. Dimensioning and verification of earth dams – determination of cross-sectional geometry, analysis of seepage conditions, and basic stability calculations.
4. Outlet ans spillway structures – structural configurations, capacity sizing, hydraulic calculations for spillways and bottom outlets, and energy dissipation.
5. Safety and operation – primary monitoring methods, interpretation of observation data, and assessment of typical risks to dams and outlet structures.

Marine part:

1. Vertical-wall gravity breakwaters and hydrodynamic loads resulting from the impact of a wave breaking in front of the breakwater structure (Minikin's formula and similar equations).
2. Types of construction solutions of offshore platforms (fixed steel platforms, jack-up platforms and semi-submersible oil rigs) and offshore wind farms.
3. Hydrodynamic loads acting on tubular elements of offshore platforms and wind farms (drag and inertia forces in the MORISON formula).
4. Foundation of jack-up oil rigs on the seabed consisting of non-cohesive or cohesive soils - the issue of penetration cavern under the platform legs).
5. Construction and operation of subsea pipelines - analysis of conditions for safe transmission of the medium.

Course content – project

Inland part:

Conceptual design of an earth dam – development of the earth dam concept, including the selection of basic geometric parameters and the design of an outlet structure.

Marine part:

Design calculations related to thermodynamic issues on offshore platforms (calculation of the maximum permissible thermal radiation in selected working zones on the deck of the oil rig) and in submarine pipelines (calculation of the temperature profile along the length of the pipeline).

Prerequisites and co-requisites

Not given

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
oral defense of the project task	60.0%	100.0%

Recommended reading

Basic literature

1. Depczyński W., Szamowski A., Budowle i zbiorniki wodne. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1999.
2. Wiłun Z., Zarys geotechniki. Wydawnictwa Komunikacji i Łączności.
3. Ustawa z dnia 20 lipca 2017 r. – Prawo wodne, z późniejszymi zmianami.
4. Rozporządzenie Ministra Infrastruktury z dnia 4 maja 2026 r. w sprawie warunków technicznych, jakim powinny odpowiadać budowle hydrotechniczne i ich usytuowanie Dz.U. 2026 poz. 692.
5. Hueckel S.: Budowle morskie. Tomy I-IV, Wydawnictwo Morskie, Gdańsk 1972.
6. Karlic S.: Zarys górnictwa morskiego. Wydawnictwo Śląsk, Katowice 1983.
7. Magda W.: Budownictwo morskie. Wybrane zagadnienia wraz z przykładami obliczeniowymi. Wydawnictwo Naukowe PWN, Warszawa 2022.
8. Magda W.: Rurociągi podmorskie. Zasady projektowania. Wydawnictwo Naukowo-Techniczne, Warszawa 2004.
9. Mazurkiewicz B.: Encyklopedia inżynierii morskiej. Fundacja Promocji Przemysłu Okrętowego i Gospodarki Morskiej, Gdańsk 2009.
10. Mazurkiewicz B.: Stałe pełnomorskie platformy żelbetowe, Wydawnictwo Morskie, Gdańsk 1985.
11. Mazurkiewicz B.: Stałe pełnomorskie platformy stalowe, Wydawnictwo Morskie, Gdańsk 1988.
12. Poradnik hydrotechnika. Praca zbiorowa pod red. S. Massela, Wydawnictwo Morskie, Gdańsk 1992.

	Supplementary literature	1. USACE, EM 1110-2-2300: General Design and Construction Considerations for Earth and Rock-Fill Dams – zasady projektowania i wykonywania zapór ziemnych i narzutowych. publications.usace.army.mil 2. USACE, EM 1110-2-1603: Hydraulic Design of Spillways – podstawy obliczeń hydraulicznych przelewów. publications.usace.army.mil 3. USACE, EM 1110-2-1602: Hydraulic Design of Reservoir Outlet Works – projektowanie hydrauliczne urządzeń spustowych zbiorników. Engineer Manuals 4. PN-EN 1997-1, Eurokod 7: Projektowanie geotechniczne – Część 1: Zasady ogólne, wraz z aktualnymi dokumentami wdrażającymi. 5. Dawson T.H.: Offshore Structural Engineering, Prentice-Hall, Englewood Cliffs, New Jersey 1983. 6. Gerwick B.C.: Construction of Offshore Structures, John Wiley & Sons, New York 1986. 7. Reddy D.V., Arockiasamy M.: Offshore Structures, Krieger Publishing Company, Malabar, Florida 1991. 8. Shore Protection Manual, USA, 1984. 9. Inżynieria morska i geotechnika (dwumiesięcznik). 10. Morskie budowle hydrotechniczne. Zalecenia do projektowania i wykonawstwa. Praca zbiorowa pod redakcją B. Mazurkiewicza, Fundacja Promocji Przemysłu Okrętowego i Gospodarki Morskiej, Gdańsk 2019.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Not given	
Practical activites within the subject	Not applicable	

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