GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00057289		
Field of study	Ocean Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Paweł Dymarski	
	Teachers	dr hab. inż. Paweł Dymarski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	18.0	0.0	9.0	0.0	0.0	27
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	27	10.0	63.0	100

Subject objectives

The aim of the course is for students to master mathematical models describing the dynamics of the marine environment in order to determine (calculate) the forces acting on offshore and coastal objects such as:
ships
offshore facilities:
- drilling rig
- offshore wind turbines (OWT):
-> bottom-fixed OWT structures
-> floating wind turbine structures
other offshore structures

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U04] can apply mathematical methods and models and computer simulations to analyse, design, and assess the functioning of ocean technology objects and systems and their elements	The student is able to use mathematical methods and models, as well as computer simulations to model the dynamics of the environment. The student has a preliminary knowledge of the influence of the environment on objects of simple geometry.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K7_U06] when forming and solving design tasks can see their non-technical aspects, including environmental, economical and legal ones. Applies HSE rules and regulations	The student is able to take into account the aspects of the environmental impact on the structure when formulating and solving design tasks.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W03] has a widened knowledge in the range of reliability and safety of ocean technology objects and systems and environmental protection in ocean technology	The knowledge obtained in the course of the course can be used to carry out a safety analysis of offshore structures.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W05] has an organized, widened knowledge on design, construction and operation of ocean technology objects and systems	As part of the course, the student will acquire knowledge useful in carrying out design analyzes of ocean engineering objects	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	1. Basic equations governing the motion of fluids 2. Gravitational stability of water masses (vertical movements) 3. Progressive movement of water masses 4. Tides 5. Wave motion of the sea 5.1 Linear wave model (Airy model) 5.2 Regular wave 5.2.1 Basic quantities describing a regular wave 5.2.2 Basic properties of a regular wave. 5.3 Irregular wave 5.3.1 Sea wave record analysis. Basic concepts describing an irregular wave 5.3.2. Spatial (omnidirectional) and plane (unidirectional) irregular wave 5.3.3 General equation for irregular waves 5.3.4 Wave energy spectrum. Mathematical description of the wave spectrum 5.3.5 Determination of irregular wave parameters based on the wave spectrum 5.3.6 Determining the irregular wave equation from the wave spectrum. 5.4 Higher order wave models 6. Wind 6.1 Laws governing the movement of air (atmosphere) 6.2. Basic wind models (stationary approach). Velocity profile equations 6.3. Wind as a non-stationary phenomenon 6.4.1 Analysis of the recording of the velocity of air masses as a function of time 6.4.2 Wind energy spectral density function. Mathematical models of the wind energy spectrum 6.4.3 Velocity equation for unidirectional unsteady air flow 6.4.4 Complex models describing airflow 7. Impact of the marine environment on objects of simple geometry. Basic models mathematical tools for calculating hydrodynamic forces. Introduction to modeling loads on offshore structures
Prerequisites and co-requisites	Knowledge of mathematical analysis and numerical methods: - integration: analytical and numerical methods, - trigonometric functions, - spectral analysis, Fourier series, - basic knowledge of vector algebra Ability to use a spreadsheet, basic programming skills

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture	60.0%	67.0%
Labs	70.0%	33.0%

Recommended reading

Basic literature	1. Jan Dudziak Teoria okrętu, rozdział Dynamika środowiska 2. Czesław Druet Dynamika morza. Gdańsk 2000 3. A.R.J.M. Lloyd SEAKEEPING: Ship Behaviour in Rough Weather 4. S.K. Chakrabarti Hydrodynamics of Offshore Structures 5. G.J Feikema, J.E.W. Wichers The Effect of Wind Spectra on the Low-Frequency Motions of a Tanker in Survival Condition. OTC 1991
Supplementary literature	6. O.M. Faltinsen Sea Loads on Ships and Offshore Structures 7. G.Clauss, E.Lehmann, C.Östergaard Offshore Structures vol. 1 8. Barry J. Heyer and Lymon C. Reese "ANALYSIS OF SINGLE PILES UNDER LATERAL LOADING".
eResources addresses	

Example issues/ example questions/ tasks being completed	Przykładowe pytania (nie pokrywają pełnego zakresu przedmiotu) 1. Napisz równanie fali regularnej. Narysuj wykres (szkic) fali w układzie x, z, oznacz na wykresie amplitudę fali i jej długość. 2. Napisz równanie fali regularnej. Narysuj wykres (szkic) fali w układzie t,z (czas, z), oznacz na wykresie amplitudę fali i jej okres. 3. Naszkicuj kształt trajektorii cząstek wody na przykładzie a) akwenu głębokiego, b) akwenu o średniej głębokości oraz c) akwenu płytkiego. 4. Napisz równanie fali nieregularnej. Naszkicuj przykładowy wykres fali, nanieś oznaczenia okresów piku, okresów miejsc zerowych oraz oznacz amplitudy (przykładowe). 5. Pokaż na przykładach czym się różni widmo falowania wąsko- od szerokopasmowego (szkic) 6. Wypisz znane Ci wyidealizowane funkcje widmowe falowania. Zilustruj wpływ zmiany poszczególnych parametrów na kształt widma (wykresy). 7. Naszkicuj typowy profil prędkości wiatru. Podaj wzór. 8. Wymień znane Ci typy prądów morskich, naszkicuj profile prędkości, podaj wzory. 9. Sformułuj równanie Morisona, nazwij człony równania, omów wielkości w nim występujące (w tym współczynniki). Dla jakiego typu (kształt/wielkość) konstrukcji można to równanie stosować. 10. Omów metodę Froudea-Kryłowa wyznaczania sił na obiekty offshore. Na jakim założeniu opiera się metoda F-K ? (podpowiedź: w jaki sposób wyznaczamy pole ciśnień?) 11.Omów model p-y oddziałania dno(grunt)-pal
Work placement	Not applicable