GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Automation Systems and Ship Positioning Systems, PG_00062679						
Field of study	Naval Architecture and Offshore Structures						
Date of commencement of studies	February 2024		Academic year of realisation of subject	2024/2025			
Education level	second-cycle studies		Subject group	Specialty 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	1		Language of instruction	Polish			
Semester of study	2		ECTS credits	5.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Zakład Energetyki i Automatyki Morskiej -> Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Mohammad Ghaemi				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	30.0	0.0	0.0	75
	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	75		10.0	40.0		125
Subject objectives	The aim of the course is to familiarize students with the basic concepts related to automation systems on ships, ship motion dynamics, and positioning, guidance, and control systems, enabling them to acquire skills in analyzing and designing these systems in the context of safe and efficient maritime navigation.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W06] Capable of finding and utilizing credible sources of information crucial for analyzing issues within the field of study	The student possesses knowledge of methods for finding and utilizing reliable sources of information relevant to the analysis of issues related to marine control systems and ship positioning, enabling effective decision-making and solution development in this area.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W02] Explains the essence and relationships of key components describing systems and processes in ocean engineering, utilizing current knowledge from major scientific fields related to the field of study	Through critical evaluation and interpretation of the results of the analysis of automation and control systems on ships, the student gains knowledge about the key elements of solving complex problems in this area, taking into account variable maritime conditions and the diversity of available data.	[SW1] Assessment of factual knowledge
[K7_K01] Understands the need for lifelong learning, critically evaluate acquired knowledge, and comprehend the significance of knowledge in addressing cognitive and practical problems	The student is aware of the necessity for continuous learning and conducting critical analysis and evaluation of the acquired content related to automation systems on ships and positioning systems, understanding the significant role of knowledge in effectively solving both theoretical and practical problems in this area.	[SK2] Assessment of progress of work
[K7_W03] Demonstrates advanced skills in applying analytical methods and problem-solving techniques related to ocean engineering, using appropriate tools	The student has advanced knowledge in applying analytical methods and problem-solving techniques related to the design and implementation of automation systems on ships and ship positioning systems, utilizing appropriate tools.	[SW1] Assessment of factual knowledge
[K7_U02] Presents convincing and logically justified arguments regarding outcomes through critical analysis of information in diverse technical contexts and an approach to their interpretation	The student presents logically justified arguments regarding the obtained results from automation systems on ships and positioning, guidance, and control systems, through their critical analysis and interpretation.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_U01] Develops innovative strategies to solve complex and dynamic problems by synthesizing information from various sources and utilizing analytical, simulation, and experimental methods, considering environmental variability	The student is capable of developing strategies to solve complex and dynamic problems related to automation systems on ships and positioning systems, utilizing information synthesis from various sources as well as analytical, simulation, and experimental methods while considering the variability of the marine environment.	[SU4] Assessment of ability to use methods and tools

Subject contents

1. Review and understanding different marine control systems, their structure, and components, including ship's course and trajectory, ship propulsion system, ship motion stabilization, and dynamic positioning.
2. Mathematical modeling and simulation of ship motion in six degrees of freedom.
3. Sea loads and mathematical modeling of the ship environment.
4. Methods for designing and implementing ship control and positioning systems, including classical control and guidance systems, adaptive and optimal controllers, state estimators, as well as modern methods.

Prerequisites and co-requisites

Knowledge, competencies, and skills related to the fundamentals of control systems required at the level of undergraduate.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Tutorials/Exercises	50.0%	20.0%
Lecture	50.0%	40.0%
Laboratory	50.0%	40.0%

Recommended reading	Basic literature	1. Fossen T. I., Handbook of Marine Craft Hydrodynamics and Motion Control, John Wiley & Sons, 2011. 2. Domachowski Z., Ghaemi M. H., Okrętowe układy automatyki, Wydawnictwo Politechniki Gdańskiej, 2019.
	Supplementary literature	1. Thor I. Fosen: Marine Control Systems, Marine Cybernetics AS, 2002. 2. Hirdaris S. E, Elements of ship dynamics and hydromechanics, American Bureau of Shipping, July 2022. 3. Ogata K., Modern Control Engineering, 4th edition, Prentice Hall, 2002.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. What are the key components and structures of marine control systems, and how do they contribute to ship navigation? 2. Explain the concept of ship's course and trajectory control and its significance in marine navigation. 3. How does the control system of a ship propulsion system operate, and what are its main components? 4. Discuss the importance of ship motion stabilization for ensuring safety and comfort onboard 5. What is dynamic positioning, and how does it differ from traditional ship positioning methods? 6. How can mathematical modeling and simulation be utilized to analyze ship motion in six degrees of freedom? 7. What factors contribute to sea loads on a ship, and how are they mathematically modeled? 8. Explain the significance of understanding the ship environment through mathematical modeling. 9. What are the classical control and guidance systems used in ship control, and how do they function? 10. Compare and contrast adaptive and optimal controllers in the context of ship control and positioning systems.	
Work placement	Not applicable	