GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Assessment of performance of unmanned maritime vehicles (USV, UUV, AUV) by CFD and MES investigation, PG_00053662						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2026/2027			
Education level	first-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	Polish			
Semester of study	6		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Mirosław Gerigk				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	15.0	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		0.0		0.0	45
Subject objectives	The aim of the course is to familiarize the students with the basic issues related to the performance of unmanned maritime vehicles including the surface and underwater vehicle.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W12] possesses basic knowledge necessary to understand the ex-technical conditions of engineering activity, possesses basic knowledge on management, including quality management and running commercial enterprise, within the range of protection of intellectual property and patent law; knows general principles of creating and developing forms of individual entrepreneurship and basic HSE rules applicable to machine industry	The student has the ability to analyze basic issues related to the research, design and operation of unmanned vehicles in the field of theory and solving simple tasks and practical problems. This includes the topics listed in the objective and item sheet. The student is able to work in a group observing all the rules that determine professionalism.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
K6_U01	The student has the ability to solve basic problems related to the research, design and operation of unmanned vehicles, in terms of assessing the functionality, performance and safety of unmanned vehicles, including performing simple engineering tasks.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
K6_W06	The student has the ability to analyze the basic issues related to the research, design and operation of unmanned objects in the field of theory and solving practical problems, including the selection of methods and tools. This includes the topics listed in the objective and item sheet including the automatics and robotics of the mechanical systems.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
K6_U07	The student has the ability to analyze basic research problems related to the mechanics, construction and mechatronics of unmanned vehicles. These problems relate in particular to: Critical assessment of the knowledge of unmanned vehicles. Maritime unmanned vehicles. Unmanned ground vehicles - UGV. Unmanned aerial vehicles - UAV. Unmanned vehicles - research issues (phenomena, parameters, characteristics, features). Unmanned vehicles - design. Unmanned vehicles - construction and construction. Unmanned vehicles - operation, operational environment, missions, tasks. Unmanned vehicles - Challenges: structures of the near future. Unmanned vehicles - Challenges: interoperability and PB clouds. Unmanned vehicles - Challenges: PB intelligent. Unmanned vehicles - Overview of the concept of selected PB vehicles - air, land, sea.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

Subject contents

Course content – lecture
The lectures concern in turn:

Critical assessment of the state of knowledge about unmanned vehicles. Maritime unmanned vehicles including the unmanned surface vehicles USV, unmanned underwater vehicles UUV and AUV. Unmanned vehicles - research issues (phenomena, parameters, characteristics, features). Unmanned vehicles - design. Unmanned vehicles - construction and construction. Unmanned vehicles - operation, operational environment, missions, tasks. Unmanned vehicles - Challenges: structures of the near future. Unmanned vehicles - Challenges: interoperability and UMV clouds. Unmanned vehicles - Challenges: UMV intelligent. Unmanned vehicles - Overview of the concept of selected UMV vehicles - USV, UUV, AUV.

Prerequisites and co-requisites	The student should have basic information in the field of physics and applied mathematics, mathematical analysis, numerical methods, solid state mechanics, including kinetics and dynamics, construction and construction of complex technical objects, technical drawing and the basics of programming as well as mechatronics and automation.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Half term and final exam	56.0%	100.0%
Recommended reading	Basic literature	Brzezina J. M. Atak dronów. Wojskowy Instytut Wydawniczy, Warszawa 2013. Cwojdziński L. Bezzałogowe Systemy Walki - charakterystyka, wybrane probelmy użycia i eksploatacji. Wojskowa Akademia Techniczna, Warszawa 2014. Dougherty M.J. Drony - ilustrowany przewodnik po bezzałogowych pojazdach powietrznych i podwodnych (Drones. An illustrated Guide to the Unmanned Aircraft That Filling Our Skies). Wydawnictwo BELLONAS.A., © 2015 Amber Books Ltd. Gerigk M.K. Modeling of performance and safety of a multi-task unmanned autonomous maritime vehicles (in Polish: Modelowanie ruchu i bezpieczeństwa wielozadaniowego bezzałogowego autonomicznego pojazdu wodnego). Journal of KONBIN, Safety and Reliability Systems, No. 1 (33), Warsaw 2015. Gerigk M.K., Wójtowicz S. An Integrated Model of Motion, Steering, Positioning and Stabilization of an Unmanned Autonomous Maritime Vehicle. TRANSNAV the International Journal on Marine Navigation and Safety of Sea Transportation. Volume 9, Number 4, December 2015, DOI: 10.12716/1001.09.04.18. Gerigk M.K. Challenges associated with the design of a small unmanned autonomous maritime vehicle. Scientific Journals of the Maritime University of Szczecin, No. 46 (118) 2016, DOI: 10.17402/113, Published: 27.06.2016. Gerigk M.K. Modeling of combined phenomena affecting an AUV stealth vehicle. TRANSNAV the International Journal on Marine Navigation and Safety of Sea Transportation, Vol. 10, No. 4, December 2016, DOI: 10.12716/1001.10.04.18. Gerigk M.K. Modeling of performance of a AUV vehicle towards limiting the hydro-acoustic field. TRANSNAV the International Journal on Marine Navigation and Safety of Sea Transportation, Volume 12, Number 4, December 2018, DOI: 10.12716/1001.12.04.06. Gerigk M.K. Modeling of performance of an AUV stealth vehicle. Design for operation. Proceedings of IMAM 2017, 17th International Congress of the International Maritime Association of the Mediterranean, Lisbon, Portugal, 9-11 October 2017. Volume 1, @ 2018 Taylor & Francis Group, London. A Balkema Book, ISBN 978-0-8153-7993-5, pp. 365-369. Kalicka R. Podstawy automatyki i robotyki. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2016. Ty Audronis. Drony- wprowadzenie, Technologia i rozwiazania (Building Multicopter Video Drones). Wydawnictwo HELION, © 2015 Helion S.A.	

	Supplementary literature	AUVSI/ONR,2007. Engineering Primer Document for the Autonomous Underwater Vehicle (AUV) Team Competition Association for Unmanned Vehicle Systems International (AUVSI) US Navy Office of Naval Research (ONR), Version 01 - July 2007. Szulist N., Gerigk M.K., 2015. Metodyka nadawania cech stealth małym bezzałogowym pojazdom wodnym. Logistyka, nr 4, Poznań 2015.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Define the Unmanned Maritime Vehicle. 2. Describe the types of unmanned maritime vehicles UMV: - unmanned surface vehicles USV - unmanned underwater vehicles UUV - autonomous underwater vehicles 3. Describe the key technologies deciding about the development of the maritime unmanned vehicles UMV.	
Practical activites within the subject	Not applicable	

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