GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00056128						
Field of study	Mechatronics						
Date of commencement of studies	October 2022		Academic year of realisation of subject	2024/2025			
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						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Mirosław Gerigk				
	Teachers						
Lesson types and methods of instruction	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		0.0		0.0	30
Subject objectives	The aim of the lectures is to present to the students the basic technologies associated with development of the unmanned and autonomous vehicles as well as the mechanics of unmanned vehicles including the structure, strength and motion. The main aim is to present the key issues of design of the unmanned vehicles.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W08] knows and understands design and production processes of elements and simple mechatronic devices	A student has an ability to analyze the basic technologies necessary to design and manufacture the elements and simple mechatronic subsystems for the data unmanned vehicle. A student has the basic abilities to analyze the structure, strength and motion of unmanned vehicles. He has the basic knowledge on design of unmanned vehicles.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
	[K6_W10] has a basic knowledge about development trends in terms of engineering and technical sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering, adequate for Mechatronics curse	A student has the basic knowledge concerning the further development of sciences, technologies and implementations connected with the unmanned vehicles including the mechanical engineering and particularly including the structure, strength and mechanics of motion of the unmanned vehicles.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
	[K6_U05] is able to use properly choosen tools to compare design solutions of elements and mechatronics systems according to given application and economic crtierions (e.g. power demand, speed, costs)	A student is able to choose and use the tools including the methods, models and algorithms to perform the analysis concernig the implemented subsystems of the unmanned vehicles according to the operational criteria. A student is able to select the tools to analyze the strength of structure and mechanics of motion of the unmanned vehicles. A student is able to select the tools for design of the unmanned vehicles.	[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_U06] is able to identify and formulate specification of simple, practical engineering tasks, distinctive for mechatronics	A student is able to identify and formulate the simple tasks, concerning the structure, strength and mechanics of motion, as well as on design of unmanned vehicles, and associated with implementations concering the unmanned vehicles which are closely connected with mechatronics.	[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_W11] has a basic knowledge about the life cycle of mechatronic systems and objects	A student has the basic knowledge on the life cycle of the unmanned vehicles including their mechatronic subsystems. A student has the basic knowledge on the structure, strength and motion of the unamnned vehicles.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

Subject contents	The lectures concern, in turn the key technologies associated with the unmanned vehcles: - autonomous systems - sensors and effectors - materials (AI materials, nano-materials) - energy supply - innovative propulsion - IT technologies (communication, navigation, steering) - stealth - cosmic and satelite technologies and - others Then, the following will be discussed: 0. Methodology of design, methods, models and design system 1. Hull form geometry and arrangement of internal spaces 2. Materials 3. Mass estimation and centre of gravity - analysis of hydromechanic characteristics - analysis of strength od structure 4. Energy supply system 5. Propulsion system 6. System of sensors 7. system of effectors 8. Steering and control 9. Navigation system 10. Communication 11. Tests

	12. Others	
Prerequisites and co-requisites	The student should have basic information in the field of applied physics and mathematics, mathematical analysis, numerical methods, mechanics, including kinetics and dynamics, strength of structure, mechatronics, programming and general design.	
Assessment methods and criteria	Subject passing criteria: Half-exam and final exam	Passing threshold: 56.0% / Percentage of the final grade: 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	1. Gerigk M.K. Badania interdyscyplinarne i rozwój zaawansowanych technologii w projektowaniu innowacyjnych platform i obiektów pływających. PISMO PG, Politechnika Gdańska, Nr 2 (209) Rok XXIII, Luty 2016. 2. Gerigk M.K. Technologie stealth w projektowaniu innowacyjnych obiektów pływających. PISMO PG, Politechnika Gdańska, Nr 4 (211) Rok XXIII, Kwiecień 2016. 3. Gerigk M.K. Konstrukcje bliskiej przyszłości. "PREZENTUJ BROŃ", 14th BALT-MILITARY-EXPO Baltic Military Fair, Gdańsk, June 20-22, 2016. 4. Gerigk M.K. Pływające konstrukcje bliskiej przyszłości - badanie, projektowanie, budowa i wdrożenie (prezentacja, promocja projektu). II Formum Bezpieczenstwa Morskiego Państwa, Ministerstwo Obrony Narodowej, Akademia Marynarki Wojennej, Warszawa, 19 stycznia 2017 r. 5. Gerigk M.K. Proponowane innowacyjne obiekty i systemy walki podwodnej opracowywane na Wydziale Mechanicznym i Politechnice Gdańskiej - (prezentacja, promocja projektu). Seminarium zamknięte, Wydział Mechaniczny PG, Gdańsk, 16 listopada 2017 r.
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	**Q No. 1 (no more than 1 A4 page):** For the data vehicle (USV or UUV or AUV) could you please describe the basic set of forces (loads) in operation: - external forces (external loads) - internal forces (internal loads) **Q No. 2 (no more than 2 A4 pages):** For the selected vehicle could you please give the basic information (mathematical modelling) on the vehicle's motion: - degrees of freedom, - phenomena, - hydrodynamic coefficients, forces, etc. - equations of motion, - states of equilibrium, - steering and control. **Q No. 3 (no more than 1 A4 page):** For the data vehicle (AUV, UUV or USV) could you please describe: - design requirements (parameters, characteristics) and operational requirements, - assessment of performance, including the assessment of performance and safe operation, - system engineering including the tests, - operational requirements. **Q No. 4 (no more than 1 A4 page):** - mention new technologies comming which may have an impact on development of unmanned vehicles.
Work placement	Not applicable