

Subject card

	FI 41 4 11 1 DO 00050057									
Subject name and code	Electric water vehicles, PG_00059857									
Field of study	WODNE PODJAZDY ELEKTRYCZNE									
Date of commencement of studies	October 2023		Academic year of realisation of subject			2025/2026				
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		4.0					
Learning profile	general academic profile		Assessment form		assessment					
Conducting unit	Department of Electri Faculties of Gdańsk l	c Drives and E Jniversity of Te	nergy Conversion -> Faculty of Electrical and Control Engineering -> chnology					neering ->		
Name and surname	Subject supervisor dr inż. Piotr Kołodziejek									
of lecturer (lecturers)	Teachers									
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Projec	:t	Seminar	SUM		
	Number of study hours	15.0	0.0	15.0	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		10.0		45.0		100		
Subject objectives	Knowledge and skills in the fields of hydrodynamical system modeling (CFD) and electric drive design for electric water vehicles: electric jet skis, electric RIBs, houseboat, electric surfboard, surfboard with electric hydrofoil, boats with electric motor. The subject includes the design of drive systems for water vehicles: structure construction, hydrodynamics, propeller motor, gearbox, power supply system, electric motor, control system, energy storage, safety issues. Autonomous houseboat and RES systems.									
Learning outcomes	Course out	come	Subject outcome			Method of verification				
	[K6_W06] knows the structure of computers and microprocessors and the tasks of operating systems, has basic knowledge of the basics of computer software, drivers, microprocessor technology, design of simple algorithms and the operation of information networks		student justifies choice of the microprocessor unit for the water vehicle drive control system synthesis.			[SW1] Ocena wiedzy faktograficznej				
	[K6_W07] has basic knowledge related to control and automation systems		student selects control system for the water propulsion vehicle.			[SW1] Ocena wiedzy faktograficznej				
	[K6_K05] can think and act in an entrepreneurial way		student selects components of the drive system for determined ship type.			[SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce				
	[K6_W11] knows the hazards arising from devices, installations, systems and technical systems, basic principles of occupational health and safety, taking into account the role of control and security systems in controlling automation and robotics facilities		students determines safe voltage range for electric devices for the water propulsion vehicle.			[SW1] Ocena wiedzy faktograficznej				
	[K6_U04] has the ability to self- educate, among other things, in order to improve professional qualifications		student explains scientific reports needed for the project			[SU1] Ocena realizacji zadania				

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Subject contents	Course content – lecture Lecture. Introduction, definitions. Classification of electric water vehicles. Innovative water electric vehicles. Buoyancy - hydrostatic calculations, stability, resistance to motion of underwater and surface vehicles - buoyancy, gliding, hydrofoils. Composite technologies. Propellers and jet propellers. Characteristics of propellers and propulsion systems. Cavitation phenomenon. Designing propulsion systems for electric water vehicles: design assumptions, vehicle dynamics, propeller parameters, calculations and motor selection, selection of gearbox type and parameters, power supply system, controller, control system, energy storage, auxiliary systems, safety systems. Elements of a smart autonomous floating house system. Lab. Numerical modeling of surface resistance of vehicles and hydrofoil lift (CFD), simulation modeling of propulsion systems with a load model. Simulation modeling of drive systems and load models. Design of an electric propeller. Execution of structural elements using 3D printing technology. Propeller characteristics with fixed and variable pitch propeller. Elements of a smart autonomous floating house system. Computer aided production systems CAD, CAM, CAQ, CIM. Software for intelligent water vehicle systems. Project. Project of a small electric personal water vehicle: electric hydrofoil, electric SUP, electric water scooter based on RIB construction, electric outboard motor. CAD design of structural elements, 3D printing, production of small composite elements.						
Prerequisites and co-requisites	Basics of electrical engineering, automation and programming.						
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade				
and criteria	Project	50.0%	40.0%				
	Laboratory	50.0%	30.0%				
	Lecture	50.0%	30.0%				
Recommended reading			1. Abu -Rub H. Guziński J. High Performance Control of AC Drives with Matlab/Simulink John Wiley & Sons 2021 2. Dembowski A,.: Elektryczny napęd trakcyjny. WNT. Warszawa 2019 3. Mathys Charles: Electric Propulsion for Boats, 2010 4. Ray Vellinga: Hydrofoils. Design. Build. Fly. 2009 5. Choromański W., Grabarek I., Kozłowski M., Czerepicki A., Marczuk K.: Pojazdy autonomiczne i systemy transportu autonomicznego. PWN. Warszawa. 2020 6. Ehsani, Y. Gao, S. Longo, K. Ebrahimi: Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Fundamentals, Theory, and Design. M. CRC Press, 3rd Edition, 2018. 7. Polski Rejestr Statków, Rules for Classification and Construction of Sea-going Ships,,Part.II Hull, Gdańsk, 2011.				
	Supplementary literature	1. Tobis W.: Budowa i naprawa jachtów z laminatów, 2013					
	eResources addresses		, 15.15				

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Example issues/ example questions/ tasks being completed	List and describe the types of electric powered water vehicles.
	2. Discuss the principles of designing the propulsion system in relation to the type of water vehicle.
	3. Select the engine for the vehicle's electric drive and estimate the driving time as a function of vehicle speed.
	4. Discuss the characteristics of the propulsor and electric motors as well as the criteria and rules for the selection of their parameters.
	5. Discuss the properties of a hydrofoil with an electric propeller.
	6. Discuss the systems of a smart autonomous houseboat.
	7. Explain the range of applications of PMSM, BLDC, synchronous and squirrel-cage motors in water electric vehicles.
	8. How can the hydrodynamic resistance of electric water vehicles be reduced?
Practical activites within the subject	Not applicable

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