



Subject card

Subject name and code	Electric water vehicles, PG_00059857						
Field of study	Automation, Robotics and Control Systems						
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 Electric Drives and Energy Conversion -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Piotr Kołodziejek				
	Teachers		dr inż. Piotr Kołodziejek				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	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, electrical motor, control system, energy storage, safety issues. Autonomous houseboat and RES systems.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[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] Assessment of task fulfilment		
	[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] Assessment of factual knowledge		
	[K6_K05] can think and act in an entrepreneurial way	student selects components of the drive system for determined ship type.			[SK5] Assessment of ability to solve problems that arise in practice		
	[K6_W07] has basic knowledge related to control and automation systems	student selects control system for the water propulsion vehicle.			[SW1] Assessment of factual knowledge		
	[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] Assessment of factual knowledge		

Subject contents	<p>Course content – lecture  <b>Lecture.</b> 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.</p> <p>Course content – laboratory  <b>Lab.</b> 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.</p> <p>Course content – project  <b>Project.</b> 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.</p>														
Prerequisites and co-requisites	Basics of electrical engineering, automation and programming.														
Assessment methods and criteria	<table border="1" data-bbox="448 584 1487 719"> <thead> <tr> <th data-bbox="448 584 794 618">Subject passing criteria</th> <th data-bbox="794 584 1141 618">Passing threshold</th> <th data-bbox="1141 584 1487 618">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 618 794 651">Lecture</td> <td data-bbox="794 618 1141 651">50.0%</td> <td data-bbox="1141 618 1487 651">30.0%</td> </tr> <tr> <td data-bbox="448 651 794 685">Laboratory</td> <td data-bbox="794 651 1141 685">50.0%</td> <td data-bbox="1141 651 1487 685">30.0%</td> </tr> <tr> <td data-bbox="448 685 794 719">Project</td> <td data-bbox="794 685 1141 719">50.0%</td> <td data-bbox="1141 685 1487 719">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Lecture	50.0%	30.0%	Laboratory	50.0%	30.0%	Project	50.0%	40.0%
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<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> <li>1. List and describe the types of electric powered water vehicles.</li> <li>2. Discuss the principles of designing the propulsion system in relation to the type of water vehicle.</li> <li>3. Select the engine for the vehicle's electric drive and estimate the driving time as a function of vehicle speed.</li> <li>4. Discuss the characteristics of the propulsor and electric motors as well as the criteria and rules for the selection of their parameters.</li> <li>5. Discuss the properties of a hydrofoil with an electric propeller.</li> <li>6. Discuss the systems of a smart autonomous houseboat.</li> <li>7. Explain the range of applications of PMSM, BLDC, synchronous and squirrel-cage motors in water electric vehicles.</li> <li>8. How can the hydrodynamic resistance of electric water vehicles be reduced?</li> </ol>
<p>Practical activities within the subject</p>	<p>Not applicable</p>

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