GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Automation of Ship Systems, PG_00046098		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Control Engineering -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Roman Śmierzchalski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	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	2.0	18.0	50

Subject objectives

Knowledge of the ship's command and control systems and the technical requirements for these systems. Working knowledge of the ship's automated electrical power system, main propulsion control systems, ship's auxiliary equipment. In the field of cargo systems, the lecture will provide familiarity with the ship's automated refrigeration systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_U03	Student will be able to prepare a presentation on the command and control structure, configuration, operating principles and parameter selection of selected automated ship systems.	[SU5] Assessment of ability to present the results of task
K7_U04	Student has knowledge of the automation of the ship's navigational, cargo and energy systems, the regulations and requirements of classification societies for automation systems on board.	[SU3] Assessment of ability to use knowledge gained from the subject
K7_W06	Student extends the knowledge of regulation, command and control in ship systems and integrated shipboard control systems.	[SW3] Assessment of knowledge contained in written work and projects
K7_U07	Student is able to design a selected automated ship system, determine the sets of input and output signals and the ranges of parameter variation, technical assumptions, functions performed in the control and control system, and control modes.	[SU1] Assessment of task fulfilment
K7_W11	Student extends the knowledge of computerised shipboard systems and controls.	[SW1] Assessment of factual knowledge

Subject contents	Ship as a control object, division into systems and subsystems. Scope of automation of the ship's navigation, cargo and power systems. Regulations and requirements of classification societies for ship automation systems. Regulation, command and control in ship systems. Integrated control system on a ship. Automation of the electrical power system. Automated ship power plants. Generator set automation, automatic synchronisation of generators, active and reactive power distribution. Automation system solutions used on ships from companies: Kongsberg, Simens, SAM. Control algorithms for the cooperation of shaft generators with combustion engine driven generators. Shaft generator systems with frequency stabilisation, principle of operation, control algorithms. Cooperation of turbogenerators using exhaust gas heat with base generators. Control algorithms. Control of emergency generator set. Methods of starting combustion engines. Engagement of emergency generator set in case of mains power failure. Ship propulsion system automation. Remote control of internal combustion engines. Block diagram. Control algorithms. DENIS standard. Internal combustion engine remote control system using AutoChief 4 as an example. Emergency control. Speed controllers for internal combustion engines. Systems for remote control of an adjustable propeller. Automation of auxiliary systems. Starting air system automation. Control methods for compressor units. Fuel system automation. Control of fuel transfer pumps. Fuel centrifuge automation systems. Operating principle, control algorithms. Automatic control systems for fuel temperature and viscosity. Automatic control systems for main engine air charging system. SG and SP lubrication system automatics. Control of conveying pumps, circulating pumps. Lubricating oil temperature control. Internal combustion engine cooling system automatics. Sea and fresh water circulation pumps control. Temperature control of fresh water. Automation of steam generation system. Control systems for water level, steam pressure, boiler efficiency and flue gas oxygen content. Parallel operation of boilers. Boiler burner control systems. Remote control systems for bilge, cargo and fuel system valves. Automation systems for cargo refrigeration rooms on cargo and fishing vessels. Solutions of refrigeration systems used on ships by ABB, York Marine, Sabroe. Capacity and temperature control. Operation of refrigeration control units. Refrigerated container systems. Power supply and power distribution on vessels carrying refrigerated containers. As part of the course, a visit to the Repair Yard in Gdańsk to a ship in the final stage of repair or construction is planned.
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Final examination	60.0%	100.0%

Recommended reading	Basic literature	1. Śmierzchalski R.: Automatyzacja systemów energetycznych statków, Wydawnictwo Gryf, Gdańsk 2004. 2 R.Śmierzchalski, (ed.) Automation of Ship Energy Systems - laboratory, , Part I and II. Wydawnictwo Akademii Morskiej w Gdyni, Gdynia 2004. 3. M Filipek, R. Śmierzchalski; Refrigerated containers automation, operation and diagnostics, textbook, pp. 152, Gryf, Gdynia 2007. 4 Hall Dennis T.: Practical Marine Electrical Knowledge, second edition, Witherby 1999. 5. McGeorge H.D., Marine Electrical Equipment and Practice, Butterworth-Heinemann, Oxford 1993. 6 Sołdek J.: Automated Ships, Wydawnictwo Morskie, Gdańsk 1985. 7. Weller W.: Automatyzacja statku, Wydawnictwo Morskie, Gdańsk 1974. 8. Wyszkowski J., Wyszkowski S.: Elektrotechnika okrętowa - napędy elektryczne, Fundacja Rozwoju Wyższej Szkoły Morskiej w Gdyni, Gdynia 1998. 9. Wyszkowski S.: Elektrotechnika okrętowa, tom 1, Wydawnictwo Morskie, Gdańsk 1991. 10. Zatorski W., Figwer J.: Układy wzbudzenia okrętowych prądnic synchronicznych, Wydawnictwo Morskie, Gdańsk 1978.
	Supplementary literature	1. Technical documentation of the DENIS system and the ABB, Kongsberg companies. 12. 2. Technical and shipbuilding documentation of selected auxiliary equipment. 13. auxiliary materials provided by the shipbuilder. 3. Auxiliary materials provided by the lecturer during the lecture.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		1. Automated ship power plant. 2. Marine power plant cooperating with electric propulsion. 3. Generator set automation. 4 Ship's power plant auxiliary systems: 4a - oil system, 4b - cooling water system, 4c - fuel system. 5. Automation of slow speed main engine f. Sulzer. 6 Ship cooling systems. 7. Refrigerated container automation.
Work placement		Not applicable

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