GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Automation of Ship Systems, PG_00055801 | | |
| Field of study | Automation, Robotics and Control Systems | | |
| Date of commencement of studies | February 2023 | Academic year of realisation of subject | 2023/2024 |
| Education level | second-cycle studies | Subject group | |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | Polish |
| Semester of study | 2 | ECTS credits | 3.0 |
| 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 | 10.0 | 35.0 | 75 |

**Subject objectives**

The aim of the course is to present control and control systems of ship systems and the technical requirements for these systems. The laboratory will provide students with the ability to design, based on programmable logic controllers and a visualisation system, control and steering systems for selected automated ship systems.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| K7_W08 | Student develops an extended knowlege of programme development and design of complex marine automation systems using PLC and SCADA, | [SW3] Assessment of knowledge contained in written work and projects |
| K7_U04 | Student has the ability to self-educate on the ship's automated electrical power system, main propulsion control systems, auxiliary equipment of the ship. | [SU2] Assessment of ability to analyse information |
| K7_U03 | Student will be able to prepare and deliver an oral presentation, in Polish and English, on a detailed questionnaire on marine control systems. | [SU5] Assessment of ability to present the results of task |
| K7_W06 | Student is able to design automation devices, control systems and controls in the field of ship systems. | [SW3] Assessment of knowledge contained in written work and projects |
| K7_W11 | Student applies computer-based methods and tools to the analysis, synthesis and design of marine automation systems and systems. | [SW3] Assessment of knowledge contained in written work and projects |
| K7_U07 | Student has the ability to use simulation methods to formulate and solve engineering tasks in marine automation. | [SU4] Assessment of ability to use methods and tools |

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| 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.<br><br>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 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 the emergency generator set in case of mains power failure.<br><br>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.<br><br>Automation of auxiliary systems. Starting air system automation. Control methods of compressor units. Fuel system automation. Control of fuel transfer pumps. Fuel centrifuge automation systems. Operating principle, control algorithms. Fuel temperature and viscosity automatic control systems. 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. |
| Prerequisites and co-requisites | Basic knowledge of automation and control technology. |

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
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| laboratory report | 100.0% | 50.0% |
| colloquium | 60.0% | 50.0% |

**Recommended reading**

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| Basic literature | 1. Śmierzchalski R.: Automation of Ship Power Systems, Wydawnictwo Gryf, Gdańsk 2004.<br>2 Śmierzchalski R., (ed.) Automation of Ship Power Systems - laboratory, , Part I and II. Wydawnictwo Akademii Morskiej w Gdyni, Gdynia 2004.<br>3. M Filipek, R. Śmierzchalski; Refrigerated containers automation, operation and diagnostics, textbook, pp. 152, Gryf, Gdynia 2007.<br>4 Hall Dennis T.: Practical Marine Electrical Knowledge, second edition, Witherby 1999.<br>5. McGeorge H.D., Marine Electrical Equipment and Practice, Butterworth-Heinemann, Oxford 1993.<br>6 Sołdek J.: Automated Ships, Wydawnictwo Morskie, Gdańsk 1985.<br>7. Weller W.: Automatyzacja statku, Wydawnictwo Morskie, Gdańsk 1974.<br>8. Wyszkowski J., Wyszkowski S.: Elektrotechnika okrętowa - napędy elektryczne, Fundacja Rozwoju Wyższej Szkoły Morskiej w Gdyni, Gdynia 1998.<br>9. Wyszkowski S.: Elektrotechnika okrętowa, tom 1, Wydawnictwo Morskie, Gdańsk 1991.<br>10. Zatorski W., Figwer J.: Układy wzbudzenia okrętowych prądnic synchronicznych, Wydawnictwo Morskie, Gdańsk 1978. |
| Supplementary literature | 1. Technical documents of the DENIS system and of ABB, Kongsberg.<br>2. Technical and shipyard documentation of selected auxiliary equipment.<br><br>Auxiliary materials provided by the teacher during the lecture. |
| eResources addresses | Adresy na platformie eNauczanie: |

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| Example issues/ example questions/ tasks being completed | Przedstaw system automatycznej pracy pomp wody chłodzącej silnik główny w układzie standby.<br><br>Introduce a system for automatic operation of the main engine cooling water pumps in standby. |
| Work placement | Not applicable |