GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Basics of automation, PG_00055281
Field of study	Design and Construction of Yachts

Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to practical vocational preparation
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	3.0
Learning profile	practical profile	Assessment form	assessment

Conducting unit	Institute Of Naval Architecture -> Faculty Of Mechanical Engineering And Ship Technology -> Wydziały Politechniki Gdańskiej

Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mohammad Ghaemi
	Teachers	dr inż. Mohammad Ghaemi mgr inż. Jacek Frost

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	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	20.0	75

Subject objectives	The aim is to get acquainted with the basis of control theory and with the structures and elements of basic automation systems, as well as general information on the design of control systems.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_W04	The student is able to assess usefulness of typical methods and tools applied in engineering to select the proper method and tool for solving the simple problems in the range of control system	[SW1] Assessment of factual knowledge
	K6_U05	The student is able to formulate simple engineering problems and its specification in the range of control system	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	1. Basic concepts: modeling of dynamic systems (mechanical, electrical, thermal, hydraulic, pneumatic), equivalence of dynamic systems, understanding of feedback, classification of control systems, basic control mechanism, technical problems of designing control systems.2. Various ways of building mathematical models, including equations of conservation of mass, momentum and energy, Lagrange's equation, Newton's second law of dynamics, Ohm's Law, etc. This includes: equations of basic linear elements, elements causing energy losses, elements storing potential energy, kinetic energy elements, introduction of equations of dynamic systems.3. Identification and linearization.4. Static characteristics of dynamic systems, differential equations, dimensionless differential equations.5. Laplace transform, transfer function.6. Block diagram and its algebra.7. Model of the dynamic/control system in state space, equations of state and observations, transfer function matrix.8. Transition from one form of the mathematical model to other forms. 9. Solution of differential equations, solution of state and observation equations, transfer function, time responses, step and impulse characteristics.10. Analysis of the most important elements of automation (7 elements).11. Frequency method for the description and analysis of control systems: spectral transmittance, A-F Nyquist characteristics, logarithmic Bode characteristics, frequency response, resonance pulsation, low- and high-band filters.12. Regulators: types of operation of regulators, structure and design of regulators, use of feedback in shaping the characteristics of the regulator, shaping the characteristics of the regulator in a parallel system, shaping the characteristics of the regulator in a sensor or amplifier, selection of the regulator due to the condition of stability of the control system.13. Control error: steady and unsteady error.14. Stability of control systems: definitions and concepts, stability in the sense of Lyapunov, Hurwitz stability criterion, Nyquist stability criterion, amplitude headroom, phase headroom.15. Control quality indicators: transient process and quality criteria, such as regulation time, rise time, overshoot, oscillation degree, logarithmic damping decrement, etc. Integral criteria, Ziegler-Nichols method for selecting controller settings.
Prerequisites and co-requisites	Prerequesties: 1. Mathematics 2. Physics

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exercises	50.0%	40.0%
	Lecture	50.0%	60.0%

Recommended reading	Basic literature	Nise N. S., Control System Engineering, 8th Edition, John Whiley & Sons Inc., 2019.
	Supplementary literature	- Friedland B., Control System Design, McGraw Hill Co., 1986. - Ogata K., Modern Control Engineering, 4th edition, Prentice-Hall, 2009. - Raven, F. H., Automatic control engineering, McGraw Hill Co., 1986.
	eResources addresses	Adresy na platformie eNauczanie: Podstawy automatyki, W/Ćw., PiBJ, sem. 04, letni 23/24 (PG_00055281) - Moodle ID: 29730 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29730

Example issues/ example questions/ tasks being completed	.
Work placement	Not applicable

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