



Subject card

Subject name and code	Fundamentals of Automatics, PG_00055288						
Field of study	Transport and Logistics						
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 scientific research in the field of study		
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		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology						
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		45.0	100
Subject objectives	The objective is to learn the fundamentals of control theory and the structures and elements of basic automation systems, as well as general information about control system design.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W04] has a basic knowledge in IT, electronics, automation and control, computer graphics useful to understand the possibilities of their application in transport		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] can formulate a simple engineering task and its specification within the range of design, construction and operation of means and systems of transport		The student is able to formulate simple engineering problems and its specification in the range of automatics and robotics		[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		

Subject contents	<p>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.</p> <p>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.</p> <p>3. Identification and linearization.</p> <p>4. Static characteristics of dynamic systems, differential equations, dimensionless differential equations.</p> <p>5. Laplace transform, transfer function.</p> <p>6. Block diagram and its algebra.</p> <p>7. Model of the dynamic/control system in state space, equations of state and observations, transfer function matrix.</p> <p>8. Transition from one form of the mathematical model to other forms.</p> <p>9. Solution of differential equations, solution of state and observation equations, transfer function, time responses, step and impulse characteristics.</p> <p>10. Analysis of the most important elements of automation (7 elements).</p> <p>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.</p> <p>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.</p> <p>13. Control error: steady and unsteady error.</p> <p>14. Stability of control systems: definitions and concepts, stability in the sense of Lyapunov, Hurwitz stability criterion, Nyquist stability criterion, amplitude headroom, phase headroom.</p> <p>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.</p>											
Prerequisites and co-requisites	<p>Pre-requisite subjects:</p> <p>1. Mathematics</p> <p>2. Physics</p>											
Assessment methods and criteria	<table><tr><td>Subject passing criteria</td><td>Passing threshold</td><td>Percentage of the final grade</td></tr><tr><td>Colloquium for credit from exercises</td><td>50.0%</td><td>40.0%</td></tr><tr><td>Colloquium for credit from lecture</td><td>50.0%</td><td>60.0%</td></tr></table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Colloquium for credit from exercises	50.0%	40.0%	Colloquium for credit from lecture	50.0%	60.0%
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Recommended reading	Basic literature	<p>1. Raven, F. H., Automatic control engineering, McGraw Hill Co., 1986.</p> <p>2. Nise N. S., Control system engineering, John Wiley & Sons Inc., 2000.</p> <p>3. Friedland B., Control System Design, McGraw Hill Co., 1986.</p>
	Supplementary literature	. Ogata K., Modern Control Engineering, 4th edition, Prentice Hall, 2002.
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>Podstawy automatyki, W/Ćw., TiL, sem. 04, letni 23/24 (PG_00055288) - Moodle ID: 29709</p> <p>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29709</p>
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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