GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Actuators in Control Systems - laboratory, PG_00067462		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
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	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Signals and Systems -> Faculty of Electronics Telecommunications and Informatics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	mgr inż. Aleksander Schmidt	
	Teachers	mgr inż. Aleksander Schmidt	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	20.0	0.0	0.0	20

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	20	1.0	4.0	25

Subject objectives

The aim of the laboratory is to acquire practical skills and verify theoretical knowledge obtained by the student during lectures. Students have the opportunity to become familiar with fundamental executive elements of automation in an experimental way. They conduct research and measurements on selected, real elements, using specialist equipment. Students learn in practice the important methods of using executive elements and performing measurements of the tested systems. Classes are held in groups, which positively influences the development of cooperation and communication skills.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] can design, according to required specifications, and make a simple device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	The student has acquired the ability to prepare simplified design documentation for a device or system in accordance with the requirements presented.	[SU4] Assessment of ability to use methods and tools
[K6_U02] can perform tasks related to the field of study in an innovative way as well as solve complex and nontypical problems, applying knowledge of physics, in changing and not fully predictable conditions	The student has knowledge about the operating principles of selected, most important executive elements.	[SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>Lectures:

1. Functions of actuators in automation systems: concepts of actuator, servomotor and power amplifier
2. Types, matching and sample actuator designs
3. Division of actuators in relation to the type of energy used
4. Sample design solutions for pneumatic and hydraulic actuators. Groups and types of electric actuators. Power amplifiers for actuators
5. Method of operation and types of electric motors
6. Brush DC motors. Disc motors
7. Brushless DC motors (BLDC)
8. Characteristics of DC motors
9. Losses occurring in DC motors
10. Rotating magnetic field of three-phase motors. Three-Phase AC Induction Motors Operation
11. Types and Characteristics of Three-Phase AC Induction Motors
12. Synchronous AC Motors
13. Starting Methods and Properties of Single-Phase Motors
14. Stepper Motors Characteristics and Classification
15. Reluctance Rotor Stepper Motors
16. Permanent Magnet and Hybrid Stepper Motors
17. Stepper Motor Voltage Excitation Methods
18. Dynamic Characteristics of Stepper Motors
19. DC Motor Controllers, Direction of Rotation and Torque Control Methods
20. Converter Topologies in DC Motor Controllers
21. Brushless DC Motor Controllers
22. Open Stepper Motor Control System and Closed Stepper Motor Control System
23. Microstepping control

Laboratories:

1. Methodology of measuring characteristics describing electric motors.
2. Study of dynamic characteristics of an actuator with a DC electric motor.
3. Study and interpretation of the basic properties of electromechanical and contactless switching devices.
4. Checking the characteristics of discrete drive parameters with a stepper motor (controllers, full-step and microstep operation).
5. Testing and evaluation of the rotational speed control system using an electric motor.
6. Testing the parameters and characteristics of signal amplifiers.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>1. Possess basic theoretical knowledge of automation actuators.
2. Basic knowledge about sequential process programming.
3. Ability to work in groups.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Reports of laboratory exercises</td><td>50.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. Elektrotechnika i elektronika okrętowa, Ryszard Białek, Andrzej Budziłowicz
2. Electric Motors and Drivers- Fundamentals, Types and Applications, Austin Hughes, Bill Drury
3. Electric Motor Control, Electric, DC, AC, BLDC Motors, Sang-Hoon Kim</td></tr><tr><td>Supplementary literature</td><td>1. Jerzy Kostro "Elementy, urządzenia i układy automatyki" - Czytelnia na Wydziale ETI
2. Silniki krokowe i sterowniki silników krokowych. Instrukcja obsługi sterownika SMC64 - opis w sieci http://www.wobit.com.pl.
3. Dane katalogowe przekaźników półprzewodnikowych SSR (http://sharp-world.com; http://www.irf.com)</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Verification of dynamic characteristics of a real DC motor.
2. Evaluation of ambivalent properties of micro-stepping operation of a stepping, two-phase, hybrid motor.
3. Testing of fundamental characteristics of electromechanical and solid-state relays.
4. Measurement of amplitude and phase characteristics of a signal amplifier for various loads.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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