GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mechatronics for transporttion systems, PG_00064984						
Field of study	Transport and Logistics						
Date of commencement of studies	February 2026		Academic year of realisation of subject	2025/2026			
Education level	second-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	1		Language of instruction	Polish			
Semester of study	1		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Division of Hydromechanics and Ship Design -> Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Wiesław Tarełko				
	Teachers						

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	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 objective of this subject is:

- to provide students with basic knowledge of modern mechatronic systems used in transport
- to prepare students for the design of specialized mechatronic systems used in various types of transport units

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W04] demonstrates knowledge encompassing selected issues in the field of advanced detailed knowledge, particularly in the scope of methods, techniques and tools specific to Transport and Logistics	The student: presents examples of sensor and actuator applications in mechatronic systems used in transportation and other fields enumerates the physical phenomena utilized in sensors and actuators of mechatronic systems defines sensors and actuators and classifies them according to preferred criteria	[SW1] Assessment of factual knowledge
	[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose	The student: explains the essential reasons for integrating mechanical, electronic, and informatics components to create a mechatronic system identifies the basic components of a mechatronic system describes the fundamental types of mechatronic systems presents a general overview, manufacturing processes, and application examples of microelectromechanical systems (MEMS) presents a general overview, manufacturing processes, and application examples of nanoelectromechanical systems (NEMS)	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
	[K7_U04] creatively designs or modifies, either entirely or at least in part, a transport system or process according to a given specification, considering both technical and non-technical aspects, estimating costs and utilizing design techniques appropriate for tasks within the scope of Transport and Logistics	The student: creates a basic block diagram of a mechatronic system selects a physical phenomenon that enables a sensor to perform a specified function in a mechatronic system selects a physical phenomenon that enables an actuator to perform a specified function in a mechatronic system selects appropriate sensors to perform a specified function in a mechatronic system selects appropriate actuators to perform a specified function in a mechatronic system designs a mechatronic system to perform a specified function	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

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

Introduction to Mechatronics

- Definition and scope of mechatronics
- What qualifies as a mechatronic unit?
- Does mechatronization always make sense? (Cost-benefit analysis, feasibility)

Mechatronic Systems

- Classification of mechatronic systems
- Microelectromechanical systems (MEMS):
  - General characteristics
  - Manufacturing technology
  - Examples of applications
- Nanoelectromechanical systems (NEMS):
  - General characteristics
  - Manufacturing technology
  - Examples of applications

Sensors and Actuators in Mechatronic Systems

- Physical phenomena used in sensors and actuators
- Classification of mechatronic sensors
- Sensors used to measure mechanical, thermal, and biochemical parameters
- Mechatronic actuators: types and applications

Applications in Industry and Bio-Inspired Design

- Selected mechatronic systems in the transport industry
- Nature-inspired mechatronic design (biomimicry in engineering)

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<tr><td>Prerequisites and co-requisites</td><td></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>lecture</td><td>66.0%</td><td>51.0%</td></tr>
<tr><td>laboratory</td><td>66.0%</td><td>49.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>

- Robert Munnig Schmidt, Georg Schitter, Adrian Rankers, and Jan van Eijk, *The Design of High Performance Mechatronics*, 2nd revised edition, IOS Press, 2014.
- Bishop, Robert H., *Mechatronics: An Introduction*, CRC Press, 2006.
- De Silva, Clarence W., *Mechatronics: An Integrated Approach*, CRC Press, 2005.
- Onwubolu, Godfrey C., *Mechatronics: Principles and Applications*, Butterworth-Heinemann, 2005.
- Bolton, William, *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering*, 6th edition, Pearson, 2018.
- Shetty, Devdas, and Richard A. Kolk, *Mechatronics System Design* , 2nd edition, Cengage Learning, 2010.

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<tr><td>Supplementary literature</td><td>Fukuda, Toshio (Ed.), *Mechatronics Recent Technological and Scientific Advances*, Springer, 2012.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>At the beginning of the semester, the instructor provides students with a list of all topics that will be covered in the course.
Students are aware that their knowledge will be assessed in three thematic areas.
The student will have 20 minutes to prepare the topics for discussion.
Next, the student presents the assigned topics and answers questions from the examiners, e.g. "In systems used to measure stress in a ship's hull, fiber optic sensors with Bragg gratings (FBG sensors) can be used. What is the principle of their operation?"</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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