



Lodz University
of Technology

Study programme

Faculty:	Faculty of Electrical, Electronic, Computer and Control Engineering
Major:	Mechatronics
Level of study:	second-cycle programme (magister inżynier)
Form of study:	full-time studies
Academic year:	2026/27

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Basic information

Name of the field of study:	Mechatronics
Level of study:	second-cycle programme (magister inżynier)
Study profile:	general academic
Form of studies:	full-time studies
Duration of studies (number of semesters):	3
The number of ECTS points required to complete studies:	90
Total number of hours of classes:	1127
The number of ECTS points a student obtains as part of classes conducted with the direct participation of academic teachers or other persons conducting classes:	45
Professional title awarded to graduates:	magister inżynier
ISCED code:	0719
Language of study:	polish

Assigning the course to the disciplines to which the learning outcomes relate

Discipline	Percentage share
Automation, electronics and electrical engineering	60%
Mechanical engineering	40%

Learning outcomes (in relation to the PQF)

No.	Learning outcome code	Learning Outcome Content	Reference to the universal characteristics of the first level of PRK	Reference to the second-level characteristics of the PRK, taking into account the second-level characteristics enabling the acquisition of engineering competences
1	2MCH1	Knows and understands in-depth issues related to modern solutions used in mechatronics, has structured and theoretically based knowledge covering key issues in the field of mechanical engineering, electronics and electrical engineering, relating to phenomena occurring in modern mechatronic components, systems and mechatronic systems, and knows and understands methods of using artificial intelligence algorithms and the digitization of industrial processes.	P7U_W	P7S_WG, P7S_WG_inż
2	2MCH2	Knows and understands the conditions of professional activity, including legal aspects, intellectual property protection and the principles of creating and developing various forms of entrepreneurship.	P7U_W	P7S_WK, P7S_WK_inż
3	2MCH3	Knows and understands the main development trends, technological innovations and research directions in the fields of mechatronics, including electronics, electrical engineering, computer science and mechanical engineering, as well as methods of commercializing research results.	P7U_W	P7S_WG
4	2MCH4	Is able to identify, analyse and solve complex problems in the field of mechatronics by selecting and applying appropriate methods and tools, including advanced IT techniques, and to develop, adapt and evolve new methods and tools used in the area of mechatronics, based on a critical analysis of their current functioning.	P7U_U	P7S_UW, P7S_UW_inż
5	2MCH5	Is able to formulate research hypotheses, analyze and interpret research and measurement results, and synthesize them using appropriate computational (including simulation) and experimental tools.	P7U_U	P7S_UW, P7S_UW_inż
6	2MCH6	Able to plan, organize, and execute individual work, as well as manage and collaborate with team members, taking a leading role in task completion. Communicates effectively on specialized topics with diverse audiences and conducts debates in a foreign language at a B2+ level, using mechatronics terminology.	P7U_U	P7S_UK, P7S_UO
7	2MCH7	Is able to plan his/her own development and systematically expand his/her knowledge, using appropriate learning methods, and support others in acquiring it.	P7U_U	P7S_UU
8	2MCH8	Is ready to critically evaluate his/her own knowledge and skills and use expert opinions when solving technical and research problems in the field of mechatronics. Demonstrates an entrepreneurial attitude and is able to inspire and engage in professional and social initiatives, including those in the public interest.	P7U_K	P7S_KK, P7S_KO
9	2MCH9	Is ready to take on responsible professional roles, taking into account changing needs, adherence to professional ethics and continuous professional development.	P7U_K	P7S_KR

Matrix of course modules in relation to learning outcomes and curriculum content

No.	Course name	Program content	2MCH1	2MCH2	2MCH3	2MCH4	2MCH5	2MCH6	2MCH7	2MCH8	2MCH9
1	Commercialization of Knowledge, Entrepreneurship and Business Practice	Patent law, intellectual property protection procedures, and financial analysis and innovation assessment of the projects discussed. An introduction to practical managerial, formal, and legal aspects, as well as economic fundamentals (e.g., preparing a business plan), and organizational aspects of running a business.		x	x	x			x		
2	Vibroacoustics of Mechatronic Systems	Analysis of free and forced vibrations and acoustic waves in mechanical and electromagnetic systems. Modelling and investigation of vibroacoustic phenomena in mechatronic systems using experimental and numerical methods.	x				x	x			
3	Integrated Micro- and Nanosystems	Micro- and nanoelectromechanical systems (MEMS and NEMS) and technologies for their design and manufacturing. Analysis of phenomena and mechanisms used in micro- and nanosystems, and design of simple systems using simulation methods.	x				x	x			
4	Micro- and Nanotechnologies	Technology processes and research methods used in micro- and nanoelectronics and their application in the design and manufacturing of semiconductor structures. Construction of simple devices in the laboratory, simulation of selected technology processes, and collection of materials and structures characteristics on a micro- and nano-scale.	x				x	x			
5	Virtual and Augmented Reality	Immersive technologies and principles of designing and implementing applications in virtual reality (VR) and augmented reality (AR) environments. Practical creation of simple VR/AR solutions along with an assessment of their usability.	x			x					
6	Selected Problems of Nonlinear Dynamics of Mechatronic Systems	Analysis and simulation of nonlinear dynamic systems, including phenomena of bifurcation, deterministic chaos, and multistability. Utilization of experimental and numerical methods to study the dynamics of mechatronic vibrating systems and to develop control models and algorithms.	x				x	x			
7	Artificial Intelligence Tools and Methods	Preparation for analysing and processing data using machine learning algorithms. Designing and implementing selected artificial intelligence algorithms using specialised programming tools and evaluating their effectiveness in solving engineering problems.	x			x	x				
8	Microsensors in Industrial Applications	Principles of operation and application of microsensors and microprocessor systems in industrial devices, including methods of visualisation, management and monitoring of processes. Design and programming of mobile applications and systems using microsensors for communication and signal analysis.	x				x	x			
9	Team-Based Research Project I	Conducting a research project in small teams in the field of mechatronics or related sciences using experimental, numerical or analytical methods. The project ends with the preparation of a report in a form similar to a scientific publication. A range of project topics are presented and implemented within the course. The content covered depends on the chosen topic.				x	x	x	x	x	

No.	Course name	Program content	2MCH1	2MCH2	2MCH3	2MCH4	2MCH5	2MCH6	2MCH7	2MCH8	2MCH9
10	Autonomous Robots and Indoor Vehicles	Analysis of motion dynamics, drive construction, steering mechanisms and power supply systems, as well as orientation and control principles in wheeled and tracked vehicles. Practical application of methods for designing and evaluating technical solutions in mobile robots and indoor transport systems.	x		x	x					
11	Thermal Issues in Mechatronic Systems	Heat conduction and transfer in electronic components and systems, as well as issues related to passive and active cooling. Numerical analysis of thermal phenomena in simple mechatronic structures using simulation software.	x				x	x			
12	Textronics	Principles of combining textiles, electronics, computer science, and materials engineering. Examples of textile material properties in conductive and sensing applications. Electrically conductive fibers and fabrics, printed textronics, textronic sensors and actuators, and issues related to their integration with textile structures.	x				x	x			
13	Optoelectronic Motion Analysis Systems	Structure, principle of operation and application of optoelectronic systems used for object motion analysis. Practical use of optoelectronic data acquisition systems for motion parameter measurement, calibration of measurement systems and analysis of obtained results using dedicated software.	x				x	x			
14	Electromagnetic Compatibility	Generation and propagation mechanisms of radiated and conducted electromagnetic disturbances, as well as methods and systems for their measurement. EMC standardisation, CE marking, emission, immunity and sensitivity testing of devices, and interference reduction strategies.	x				x	x			
15	Embedded Systems	Architecture and programming of microcontrollers and peripheral devices. Development and implementation of applications in embedded systems, including those with their own operating system, as well as the design of simple device drivers with communication interfaces.	x				x	x			
16	Numerical Modelling and Simulations of Mechatronic Systems	Computer methods for analysing the dynamics of mechatronic systems. Preparation numerical models, running simulations and conducting analyses using dedicated computational tools.	x				x	x			
17	Foreign Language for Specialist Purposes	B2+ level ESOKJ, proficiency in using specialized terminology in a foreign language.						x			
18	Monitoring and Management Systems for Industrial Processes	Issues related to industrial process monitoring and management systems, including material resource planning (MRP), enterprise resource planning (ERP), enterprise resource planning II (ERP II), supervisory control and data acquisition (SCADA) systems, and computerised maintenance management systems (CMMS). Practical use of these tools for analysing key performance indicators (KPIs) and evaluating the performance of automated enterprises.	x			x					
19	Analysis and Optimisation of Mechatronic Systems	Mathematical modelling, parameter identification and optimisation methods. Use of computational environments for analysis, simulation and designing of mechatronic systems.	x			x	x				
20	Team-Based Research Project II	Conducting a research task in small teams in the field of mechatronics or related sciences using experimental, numerical or analytical methods. The project results in the preparation of a report in a form similar to a scientific paper. A range of project topics are presented and implemented within the course. The content covered depends on the chosen topic.				x	x	x		x	x

No.	Course name	Program content	2MCH1	2MCH2	2MCH3	2MCH4	2MCH5	2MCH6	2MCH7	2MCH8	2MCH9
21	Internship	Execution of tasks in an industrial or research environment using the knowledge and skills achieved during studies.						x	x	x	x
22	Personalized Internet of Things	Issues related to the Internet of Things (IoT) and Industrial Internet of Things (IIoT), including personalised products. Development of IoT/IIoT applications and systems using microcontrollers, wireless communication and cloud solutions for data acquisition, processing and analysis.	x		x	x					
23	Digitisation of Industrial Systems and Processes	Issues related to aspects of Industry 4.0, including digital twins, cloud computing, and the implementation of solutions at the level of programmable controllers using high-level languages. Practical implementation of projects using industrial automation components.	x		x	x					
24	3D Modelling and Simulation of Physical Phenomena in Mechatronic Components	Three-dimensional modelling of mechatronic components and systems, and simulation of physical phenomena using numerical methods.	x			x					
25	Diploma Seminar	Preparation of a master's thesis and presentation for the final examination by conducting a bibliography overview, discussing research issues, presenting research stages, and providing practical guidance on preparing a dedicated text document and multimedia presentation. Conducting a competency exam.					x	x	x	x	x
26	Final Project	Individual development and solution of a research problem carried out as part of a master's thesis covering issues in the field of mechatronics and related disciplines. Preparation of a written report presenting the process of solving the research problem and presentation of the results obtained. Detailed content implemented depends on the chosen work topic.	x			x	x		x	x	

ECTS - subjects

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
1	Commercialization of Knowledge, Entrepreneurship and Business Practice	5	5			
2	Vibroacoustics of Mechatronic Systems	4		4	4	4
3	Integrated Micro- and Nanosystems	3		3	3	
4	Micro- and Nanotechnologies	3		3	3	
5	Virtual and Augmented Reality	3			3	
6	Selected Problems of Nonlinear Dynamics of Mechatronic Systems	4		4	4	4
7	Artificial Intelligence Tools and Methods	5			5	
8	Microsensors in Industrial Applications	3		3	3	
9	Team-Based Research Project I	5			5	
10	Autonomous Robots and Indoor Vehicles	5			5	
11	Thermal Issues in Mechatronic Systems	4		4	4	
12	Textronics	4		4	4	
13	Optoelectronic Motion Analysis Systems	4		4	4	
14	Electromagnetic Compatibility	4		4	4	
15	Embedded Systems	4		4	4	
16	Numerical Modelling and Simulations of Mechatronic Systems	4		4	4	
17	Foreign Language for Specialist Purposes	2				
18	Monitoring and Management Systems for Industrial Processes	4				
19	Analysis and Optimisation of Mechatronic Systems	6			6	
20	Team-Based Research Project II	6			6	

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
21	Internship	4		4		
22	Personalized Internet of Things	2				
23	Digitisation of Industrial Systems and Processes	3				
24	3D Modelling and Simulation of Physical Phenomena in Mechatronic Components	3			3	
25	Diploma Seminar	2				
26	Final Project	20			20	

ECTS indicators

Name	Value
The total number of ECTS credits that a student must obtain through elective courses (amounting to no less than 30% of the total ECTS credits required to obtain the qualification corresponding to the given level of study)	19/90 (21.11%)
The total number of ECTS credits to be earned by a student through courses in the fields of humanities or social sciences	5
The total number of ECTS credits that a student must obtain from courses related to research conducted at the university, amounting to more than 50% of the total ECTS credits required to graduate from a given level of study	68/90 (75.56%)

Methods of verifying and assessing learning outcomes

Verification of achieved learning outcomes requires the use of various forms of student evaluation that are suited to the categories of knowledge, skills, and social competences to which these outcomes relate. The selection of relevant instruments is also determined by the specific nature of the course and the method of teaching, as indicated in each individual course description. Achievement of the specified learning outcomes is evaluated through:

1. Written assignments (exams, tests, reports, essays, projects, posters, thesis, etc.);
2. Oral presentations (oral knowledge tests, public speaking, etc.);
3. Practical and/or project tasks (team and individual);
4. Class observation and assessment;
5. Student self-assessment and peer assessment (especially for team projects);
6. Competency and diploma exams.

Assessment can be formative (partial, repeated throughout the course) and/or summative (final grade). The final assessment result is provided based on the current grading scale. In the first class, the course director or instructor must discuss the course syllabus, formulate, and document the assessment methods and conditions for evaluating learning outcomes.

Professional internships

Duration: 4 weeks

ECTS credits earned: 4

Internships are completed in accordance with the study program, tailored to the profile and specificity of the field of study, and in compliance with the rules established by the faculty and the University.

Characteristics of the course

Graduate profile

A graduate of Mechatronics, second-cycle studies, has in-depth knowledge and skills in interdisciplinary areas related to the industrial revolution known as Industry 4.0. They have knowledge of development trends and innovative technologies, including artificial intelligence methods and tools, digitization of industrial processes, digital twins, virtual and augmented reality, robotic systems, and autonomous vehicles. They are able to use advanced research methods and IT tools supporting the design, programming, and testing of advanced mechatronic systems. The education program allows for flexible profiling of the study path through the selection of elective subjects that develop areas of knowledge consistent with current trends and the needs of the innovative industry. By completing most courses as individual and team projects, graduates have the ability to work effectively both independently and in groups. They also have competence in the use of a technical foreign language. The acquired competences prepare them to work as a specialist in the supervision, operation, and maintenance of integrated mechatronic systems in an innovative industry, including enterprises using advanced IT tools and techniques, conduct design, research, and experimental work in the areas that constitute mechatronics, with particular emphasis on the requirements of Industry 4.0, start their own business, as well as continue their education at third-cycle studies.

The relationship between the field of study and the university's strategy

The University's mission and main strategic goals were defined and precisely outlined in Resolution 39/2024 "Development Strategy of Lodz University of Technology for 2025-2030" of the Senate of Lodz University of Technology, adopted on June 26, 2024. The adopted strategy is based on the theme of multi-aspect cooperation, respecting the adopted values, making the University a valued partner for the economy. The second-cycle education supports the mission of the University and its faculties, as confirmed by the following facts:

- Students acquire competencies in: formulating and solving advanced design tasks in the field of mechatronics; acquiring knowledge in the construction of advanced mechatronic systems and components, as well as knowledge in the design and manufacture of components using microtechnology. They also gain the ability to use learned mathematical methods and models, as well as computer simulations, to analyze and evaluate the performance of components and systems, and knowledge and skills in the operation and application of machine learning algorithms and artificial intelligence algorithms.
- This field of study offers numerous examples of how both scientific knowledge and modern laboratory facilities are utilized to guide teaching, for example, Autonomous Robots and In-plant Vehicles, Vibroacoustics of Mechatronic Systems.
- The Mechatronics program is interdisciplinary, and its curriculum is closely linked to research in technical sciences and scientific disciplines such as automation, electronics, electrical engineering, and space technologies, technical computer science, and mechanical engineering.
- The courses provide substantive preparation for work in plants and design offices, in the research and development departments of leading companies in the country, often international corporations (e.g., ABB Aleksandrów, Besel Brzeg Cantoni Group, Beko, BSH), or in research units where research on innovative solutions is conducted. Acquiring the ability to work in a team, assume the role of a group leader, and lead discussions at a substantive level is particularly valuable. Graduates of this program are also prepared to start their own business or continue their studies at the third level.

The educational concept developed for students in the Mechatronics program is focused on developing human resources for the economy based on a high level of knowledge and competencies, knowledge of development trends and the needs of the region and the country. It also introduces students to industrial practice. Thanks to the acquired teamwork skills, supported by self-education and creativity in problem-solving, graduates are perfectly prepared to undertake research work in scientific and research institutions.

Educational objectives and employment and continuing education opportunities

The primary educational goal of second-cycle studies, microelectronics, electrical engineering, automation, mechanical engineering, and technical computer science. Furthermore, graduates are prepared to undertake innovative and pro-ecological activities in these areas, closely aligned with the priorities of the European Union, Poland, and the region. Additional goals include deepening their knowledge of work organization, particularly teamwork, business start-ups, intellectual property protection, work safety in technologically advanced laboratories, and fluency in a foreign language at an intermediate level. During their studies, students can flexibly shape their educational profile by choosing elective courses. We also ensure that the education obtained during the studies will enable them to undertake a variety of professional careers – i. In particular, the graduate possesses sufficient qualifications to perform design, research, and experimental work in the areas that comprise mechatronics. The education obtained opens the door to employment as a specialist in the operation and maintenance of advanced mechatronic systems, such as autonomous industrial robots, including those utilizing artificial intelligence. Graduates can find employment in high-tech design and manufacturing companies, as well as in research and development facilities. Graduates are prepared to work anywhere advanced IT tools and techniques are used, such as in the design,

production, operation, or distribution of tools and integrated mechatronic systems. In particular, they can work in various domestic and international companies utilizing advanced microtechnologies and innovative approaches to solving technical and scientific problems, as well as start their own business. It is important to note that graduates of second-cycle mechatronics studies have the opportunity to continue their studies in third-cycle studies (Level 8) related to high-tech research areas.

Description of the process and outcome of consultations on the proposed study program with the socio-economic environment

The second-cycle Mechatronics study program is based on the existing Mechatronics study program, which has been developed and implemented for many years in collaboration between the Faculty of Mechanical Engineering and the Faculty of Electrical, Electronic, Computer, and Control Engineering. It is important to note that the study program has been consulted with the socio-economic community for many years. The proposed program incorporates content from the previous program and addresses new challenges, particularly within the regional industry and in Poland. The necessary modernization of the program, which includes reducing the number of subjects in favor of larger thematic blocks (often including classes that develop self-directed learning and independent work skills), updating and adapting course content to current needs and expectations (in line with industry trends and the University's strategy), was consulted with the socio-economic community during the preparation of the new program. Consultations were conducted with companies that are part of the Entrepreneurs' Council, which collaborates with the Study Program Council. While the work of this Council is not formalized, consultations are held at least once a year and result in oral or written conclusions. For example, consultations with the Transformer Factory in Żychlin and Promis-tech Sp. z o.o. were conducted for the subject "Team Research Project I." The opinion of BSH, a leading manufacturer of household appliances, is particularly valued. Extensive collaboration with BSH includes activities such as supervising diploma theses, competency-based projects, student internships, and professional practice. The positive feedback from companies regarding the content of the second-cycle program and the competencies acquired by graduates is noteworthy. The knowledge areas related to electronics, mechanics, and vibroacoustics, represented in the program by specific subjects, were positively assessed. Two subjects, Team Research Project I and Team Research Project II, also received positive evaluations. The existing curriculum was fully consulted with Inovatica AGV and Siemens.

Description of competencies expected from a candidate applying for admission to studies

In accordance with the recruitment resolution in force for a given academic year.

The unit organizing education

Faculty of Electrical, Electronic, Computer and Control Engineering

Education program

Semester 1

Course	Number of hours	ECTS points	Form of verification	Obligatory
Commercialization of Knowledge, Entrepreneurship and Business Practice	Laboratory classes: 20 Project work: 10 Lecture: 20	5	Graded assignment	Obligatory
Virtual and Augmented Reality	Laboratory classes: 20 Lecture: 10	3	Graded assignment	Obligatory
Artificial Intelligence Tools and Methods	Laboratory classes: 30 Project work: 20 Lecture: 10	5	Exam	Obligatory
Team-Based Research Project I	Project work: 30	5	Graded assignment	Obligatory
Autonomous Robots and Indoor Vehicles	Laboratory classes: 30 Project work: 20 Lecture: 10	5	Graded assignment	Obligatory
Elective Courses 1		4	Graded assignment	Obligatory group
The Student chooses 1 subjects				
Vibroacoustics of Mechatronic Systems	Laboratory classes: 10 Project work: 10 Lecture: 10	4	Graded assignment	Optional
Selected Problems of Nonlinear Dynamics of Mechatronic Systems	Laboratory classes: 10 Project work: 10 Lecture: 10	4	Graded assignment	Optional
Elective Courses 2		3	Graded assignment	Obligatory group
The Student chooses 1 subjects				
Integrated Micro- and Nanosystems	Laboratory classes: 10 Project work: 10 Lecture: 10	3	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Micro- and Nanotechnologies	Laboratory classes: 10 Project work: 10 Lecture: 10	3	Graded assignment	Optional
Microsensors in Industrial Applications	Laboratory classes: 10 Project work: 10 Lecture: 10	3	Graded assignment	Optional
Sum	290	30		

Semester 2

Course	Number of hours	ECTS points	Form of verification	Obligatory
Elective Courses 3		4	Graded assignment	Obligatory group
The Student chooses 1 subjects				
Thermal Issues in Mechatronic Systems	Laboratory classes: 15 Lecture: 10	4	Graded assignment	Optional
Textronics	Laboratory classes: 15 Lecture: 10	4	Graded assignment	Optional
Optoelectronic Motion Analysis Systems	Laboratory classes: 15 Lecture: 10	4	Graded assignment	Optional
Elective Courses 4		4	Graded assignment	Obligatory group
The Student chooses 1 subjects				
Electromagnetic Compatibility	Laboratory classes: 10 Project work: 10 Lecture: 10	4	Graded assignment	Optional
Embedded Systems	Laboratory classes: 10 Project work: 10 Lecture: 10	4	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Numerical Modelling and Simulations of Mechatronic Systems	Laboratory classes: 10 Project work: 10 Lecture: 10	4	Graded assignment	Optional
Foreign Language for Specialist Purposes	Tutorials: 45	2	Graded assignment	Obligatory
Monitoring and Management Systems for Industrial Processes	Laboratory classes: 10 Project work: 20 Lecture: 10	4	Graded assignment	Obligatory
Analysis and Optimisation of Mechatronic Systems	Laboratory classes: 30 Project work: 30 Lecture: 20	6	Exam	Obligatory
Team-Based Research Project II	Project work: 30	6	Graded assignment	Obligatory
Internship	Internship: 0	4	Pass	Obligatory subjects to choose from
Sum	250	30		

Semester 3

Course	Number of hours	ECTS points	Form of verification	Obligatory
Personalized Internet of Things	Laboratory classes: 10 Project work: 15 Lecture: 10	2	Graded assignment	Obligatory
Digitisation of Industrial Systems and Processes	Laboratory classes: 20 Project work: 15 Lecture: 10	3	Exam	Obligatory
3D Modelling and Simulation of Physical Phenomena in Mechatronic Components	Laboratory classes: 30 Project work: 20	3	Graded assignment	Obligatory
Diploma Seminar	Seminar: 20	2	Exam	Obligatory
Final Project	Diploma Thesis: 0	20	Pass	Obligatory
Sum	150	30		