



Study programme

Organizational unit:	Faculty of Electronics, Photonics and Microsystems
Field of study:	Control Engineering and Robotics
Level of study:	second degree 3 semesters
Form of study:	full-time studies
Education cycle:	2025/2026

Table of contents

Field of study characteristics	3
Learning outcomes	7
Detailed information on ECTS points	10
Organization of studies	11
Study plan	13
Syllabuses	18

Field of study characteristics

Basic information

Organizational unit:	Faculty of Electronics, Photonics and Microsystems
Field of study:	Control Engineering and Robotics
Study level:	second degree 3 semesters
Study form:	full-time studies
Education profile:	general academic profile
Language of study:	English
Valid from the education cycle:	2025/2026
Number of semesters:	3
Total number of hours of classes:	directional: 315 Embedded Robotics: 795
Total number of ECTS points required to complete a given level of study:	90
Professional title awarded to graduates:	magister inżynier

Fields of science and scientific disciplines

Scientific disciplines to which the field of study is assigned:

Field engineering and technical sciences

Assigning the major to the fields and disciplines to which the learning outcomes relate:

Discipline	Percentage
Control Engineering, Electronics, Electrotechnics and Space Technologies	100%

Main discipline: Control Engineering, Electronics, Electrotechnics and Space Technologies

Description of the field, profile of the graduate and possibilities of continuing studies

The Automation and Robotics field of study is assigned to the Discipline of Automation, Electrical Engineering and Space Technologies and is carried out at the Faculty of Electronics, Photonics and Microsystems of Wrocław University of Science and Technology (WUST). The second stage of education, at the master's level, is mainly focused on broadening and deepening knowledge in the subject areas and improving practical skills for effective creative challenges in future professional work in widely understood applications of robotics and automation systems based on tools and methods of applied computer science.

The graduate of the course is a master degree engineer prepared to work in a wide range of automation and robotics applications. He or she has the advanced knowledge and skills necessary to design, construct and implement automation and robotics systems using techniques, tools, methods and algorithms of applied computer science. With soft skills, he can perform leadership roles in industry as well as start his own business. He can take up creative challenges in various fields of technology both as a specialist in research centers or perdue himself in scientific work.

Automation and Robotics field of study offers two Polish-language specializations named: Robotics and Electronic Automation Systems, and an English-language one: Embedded Robotics.

Robotics specialization:

The graduate's expertise includes diverse methods of control (adaptive, robust, intelligent), motion and action planning of a robot or group of robots. Its specialized skills relate to the design of robots including electronic robotic systems, robot controllers, supply systems, environmental perception systems, robot-human interfaces, and algorithms for planning robot actions and movements. Students have the opportunity to acquire practical skills, learn about new tools and technologies by performing laboratory exercises and projects on many types of robots (manipulators, service robots and social robots) and programming platforms, both general-purpose and robot-specific. Low- and high-level programming skills are assets for graduates, such as those required when applying artificial intelligence techniques in fusing data from multiple sources and processing incomplete and uncertain information. The advantage of roboticists is their versatility, combining mechanics, electronics and computer science into a synergistic whole.

Electronic Automation Systems specialization:

Graduates can apply the means of computer science to the acquisition of measurement data, control of technological processes, design, development, maintenance of automation systems and industrial robotics with the exchange of information based on standard data transmission protocols. Can design, implement, test and operate analog, digital and mixed electronic systems using electronic, optoelectronic, sensor and microprocessor components. He is competent in devices and circuits that control diverse signals, including high-current and high-voltage signals. Can find solutions to computational tasks using computer tools including DSP signal processors. Graduates are able to prepare, execute and analyze simulations and computer experiments, create advanced computer programs independently or in teams.

Embedded robotics specialization:

The specialized knowledge of Embedded Robotics graduates includes methods of control, motion planning, and robotic operations, and practical methods of building such systems, from the electronics level to formal verification. Acquired skills include the design, programming, and commissioning of microprocessor-based embedded systems, as well as robots and robotic and robotic systems, robot controllers, supplying systems, environmental perception systems, human-robot interfaces, and various types of electronic circuits. Graduates are also prepared for creative engineering activities in the field of industrial robotics and service, as well as academic and research work. Studying in English provides graduates with additional competence through in-depth knowledge of terminology, literature, as well as an asset in the form of a master's thesis written in English.

Graduates are prepared to undertake third degree studies.

Currentness of the study programme

Concept and goals of education

The Automation and Robotics field of study at the Wrocław University of Technology was initiated almost half a century ago, thanks to Prof. Jerzy Jaroń, a mathematician and cyberneticist. The concept of education, and its result in the form of an educational program, in the field of study has evolved due to changes in formal ministerial requirements. However, the timeliness of knowledge, the reliability of its transmission and high ethical standards were always a priority. Currently, the Automation and Robotics, after the change of the university's departmental structure, is based on two pillars: classical robotics, and automation, which has acquired an electronic shade. The premise is that the program should be up-to-date and adapted to both market needs and reflect the research areas of the faculty members. The concept of education draws on historically well-established patterns of knowledge transfer, without avoiding unconventional forms and ways (for example, away seminars). An important role is played by forms of student activation and self-activation carried out by numerous scientific circles, both in the department and in interdepartmental structures. Self-help groups as well as participation in various types of social actions are supposed to integrate the environment and blur traditional divisions and roles.

The educational objectives are:

1. to provide competent engineering personnel for the national economy,
2. to enable the acquisition of knowledge and skills, as well as soft competencies,
3. to broaden both strictly professional and general horizons,
4. to enable access to highly qualified staff actively conducting research in the field of automation and robotics,
5. instilling the life-long learning imperative necessary today, especially in the very rapidly changing environment of automation and robotics, and resulting from the emergence of new tools, technologies, software, or changing paradigms,
6. to enable graduates with special creative aptitude to study at the third stage of education.

Information regarding the inclusion of socio-economic needs in the study programme and the compliance of the major learning outcomes with these needs

Educating in studies of a general academic profile, the Faculty addresses its offer to graduates of first-degree studies possessing at least the professional title of engineer obtained in admitted fields of study. Detailed terms and conditions of recruitment applicable for a given academic year are approved annually by the Senate of WUST and announced by a relevant internal regulation and also at recruitment web-pages. Studies of this profile are aimed at preparing professional engineering personnel for a digital society, knowledge-based economy, including the use of intelligent technologies and tools, and creating or applying methods of widely understood applied computer science. Education in the field of Automation and Robotics is correlated with the strategic documents for the Faculty, the University and Lower Silesia.

According to the 2018 report "Opportunities and Challenges of the Polish Industry 4.0", in the near future we should expect an increased demand for employees specialized in the production and area of complex systems integrating robotics, automation, artificial intelligence and Internet of Things devices and sensors. These conclusions are confirmed in the 2019 report "Analysis of Demand for Competencies in the Economy and Labor Market" for the NCBIIR, which indicates human resource deficits in the areas of, among others, electronics, automation and robotics specialists in 3 regions of Poland, including the southwestern region, which includes the Lower Silesia and Opole regions.

The program of study of this field of study meets all the major needs and requirements of employers for automation, robotics, and specialized computer and electronics engineers. Major employers include companies of a manufacturing and service nature, including companies specializing in software development for embedded systems. Due to the dynamic development of the market, there is and will continue to be a high demand for specialists with the title of automation and robotics engineer, with the competencies necessary for the design of electronic systems devices, the use of SCADA and robotic systems, the implementation and integration of industrial installations, the design and implementation of functionality in various technologies and programming languages, the modeling of technological processes and robots. It should also be noted that the direction of Automation and Robotics is in line with the needs arising from changes in manufacturing (Industry 4.0+) and the use and design of devices and solutions from the Smart category. In Wroclaw and the Lower Silesia Region, there are many small, medium and large companies and manufacturing plants for which Automation and Robotics graduates already form the core of the workforce, and the demand for qualified engineers continues to grow. Not insignificant are the locations of large companies (INTEL) in the vicinity of Wroclaw with a high demand for technical staff of various levels.

The acquired knowledge, skills and social competencies of students/graduates in the field of Automation and Robotics are the result of the assignment of learning outcomes at a specific degree program relating to the subjects pursued. The directional learning outcomes assigned to the area of engineering and technical sciences enable students/graduates to acquire knowledge, skills and competencies covering the spectrum of engineering fields related to the field of study, in particular: automation, robotics, electronics, and more specifically: digital and microprocessor techniques, metrology, sensorics, data analysis and transmission, and programming of advanced devices and embedded systems.

The acquired basic knowledge (general) as well as detailed knowledge (specialized) of the field is broad enough for the student/graduate of the course to be able to independently and in the framework of continuing education to adapt competencies to the changing conditions and challenges they will face during their future professional activity. Such are the expectations of employers implementing modern work organization and innovative technologies in their companies. The effects assigned to the subjects, achieved during the educational process, will ensure, in accordance with the expectations of future employers, that the graduate will have knowledge of development trends and new, recently implemented achievements, not only in the area of automation and robotics, electronics, computer science, optoelectronics, but also in such fields of application: medicine, autonomous means of transportation, human-robot interaction, and contemporary technological developments.

The assumed effect, achieved in the educational process, concerning knowledge is that the graduate possesses knowledge concerning the transfer of technology, as well as knowledge related to management and business operations. In addition, the educational effect is general knowledge of social communication necessary in managing human teams. The above effects are achieved through the realization of general subjects. This kind of body of knowledge from a graduate is expected by the modern labor market. The learning outcomes included in the course charters, implemented in the course, ensure in addition, the achievement by the graduate of the ability to integrate knowledge from various fields and disciplines with the application of a systems approach when formulating and solving engineering tasks. The labor market expects that the results achieved in the educational process will ensure that the graduate is prepared to work in an industrial environment. The student/graduate should see the need to improve and enhance the production process, or the existing technical solutions at the workstation. Having achieved the established learning outcomes, he/she will be able, taking into account non-technical aspects, according to the given specification, to design and manufacture (using appropriate methods, techniques and tools) of a complex device, system or process.

Thus, bearing in mind that the task of the learning outcomes assumed and achieved in the course of training is to meet, to the greatest extent possible, expectations of entrepreneurs employing our graduates, an important element in assessing the quality of the educational process are hospitalizations and surveys of faculty conducted during each semester hospitalizations and departmental surveys aimed at students/graduates.

Verification of the compatibility of the assumed learning outcomes with the expectations and needs of the market also takes place during numerous contacts between our graduates and faculty members, and is the scope of activities and competencies of the Faculty Quality Assurance Committee.

Other important factors determining the validity of the study programme

Today's turbulent development of artificial intelligence, AI, is already significantly impacting the digital economy, economics and society. However, it is now mainly the domain of complex and diverse data processing or facilitates the use of data (advisory systems). A much more difficult and algorithmizable part of the planned development is the manufacturing part, which is the domain of the Automation and Robotics major. And it is this part that directly determines economic efficiency.

For manufacturers both large-scale (corporations), local manufacturers, start-ups or spin-offs, including in the broad district of the Wroclaw agglomeration, it is necessary to obtain graduates who are flexible and comprehensively educated in various segments. The direction of Automation and Robotics provides computer competence to graduates in data acquisition, transmission and processing, and analysis; competence in the ability to design, construct, program, operate and evaluate diverse and complex automation and robotics systems.

An attributive feature of the field of study is the versatility of the education offered, combining strictly practical skills with advanced theoretical competencies and a response to modern paradigms of technology. The demand for personnel in the field of Automation and Robotics, so far high, can only grow, as there is a visible and necessary change in the organization of production from an approach based on cheap labor (minimum wage) to production based on innovation, automation and robotization. Modern education in the described field of study is needed and justified.

The connection of the programme with the University's mission and its development strategy

Wroclaw University of Science and Technology (WUST) is a technical university whose goal is to educate students and doctoral students, as well as research activities serving society. The past and present activities, both teaching and research, are reflected in the curriculum of the degree program in Automation and Robotics, which is fully correlated with the university's mission and development strategy for years 2023-2030 adopted by the Senate of the WUST. In particular, the study program makes use of the sector models defined in section 7 of the Development Plan of WUST: Education Model and Study Model, in order to ensure high quality teaching. Students of the faculty follow the study model defined in the development strategy of the Faculty of Electronics, Photonics and Microsystems adopted by an appropriate resolution of the Faculty Council and consistent with the overarching university strategy. The program also takes into account the strategic outlook set by the Ministry of Science and Higher Education.

The educational program is influenced not only by statutory advisory bodies, but also by less formal feedback from graduates practically evaluating the acquired knowledge and skills in their professional lives. Thanks to their theoretical and practical competence, the staff shaping the curriculum draws on the experience gained during the implementation of research topics with both industrial and academic partners - domestic and foreign. Education in the field of Automation and Robotics is concurrent with the strategic framework for smart specialization of Lower Silesia in the area of electronics in the broadest sense, including automation and robotics. In line with the research and teaching activities with a general academic profile, the Faculty addresses its offer to graduates of engineering studies in the specified fields.

Learning outcomes

Code	Description of the directional learning outcome	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework, enabling the acquisition of engineering competences
Knowledge			
K2_AIR_W01	Has a broadened and deepened knowledge of selected branches of mathematics and physics necessary to understand issues in the scientific discipline studied.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W02	Describes the process of creation or development of forms of individual entrepreneurship in the area relevant to the studied field of study, including the protection of industrial property and copyright law.	P7U_W, P7S_WK	
K2_AIR_W03	Lists, describes and classifies modern methods of optimal control theory.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W04	Characterizes methods for modeling the random environment and methods for identifying systems.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W05	Lists and describes advanced concepts and analytical methods used in automation and robotics, necessary for the formulation of models, description of properties and proposals for control algorithms.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W06	Classifies and characterizes different types of control algorithms for robotic systems, taking into account motion constraints, model inaccuracy, providing robustness and having adaptability.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W07	Lists and describes the formalisms of selected discrete event systems (DES) in terms of theory and applications in automation and robotics, including finite state automata and selected classes of Petri nets.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W08	Describes main paradigms of knowledge representation, artificial intelligence and machine learning algorithms and their applications in social robots.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W09	Enumerates and characterizes: tasks, methods and algorithms of robot motion planning and has knowledge of modeling the robot's environment enabling localization, map construction and navigation.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W10	Knows the cycle and its stages regarding design issues of robotic embedded and distributed systems using a dedicated environment to facilitate system implementation.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W11	Lists and describes principles of using electronic components used in industrial automation systems and power electronics.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W12	Enumerates and describes fundamental principles of optoelectronics in the scope of generation, detection and processing of optical radiation and the design of lasers used in industrial systems.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W13	Characterizes algorithms used in data processing and control of automation devices and lists and described main principles of machine learning.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W14	Lists and describes sensors and actuators used in automation systems.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_AIR_W15	Classifies and describes methods of data transmission in industrial networks. Characterizes wired and wireless interfaces.	P7U_W, P7S_WG	P7S_WG_INŻ
Skills			

Code	Description of the directional learning outcome	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework, enabling the acquisition of engineering competences
K2_AIR_U01	Has up-to-date knowledge of development trends and new developments in the area of the studied scientific discipline. Is able to independently realize a master's thesis containing research aspects. In particular: gathers information from different sources, plans and carries out experiments and computer simulations, formulates and tests hypotheses related to research problems, interprets obtained research results, draws conclusions and formulate recommendations and prepares master's thesis in accordance with formal requirements.	P7U_U, P7S_UW, P7S_UU	P7S_UW_INŻ
K2_AIR_U02	Can think critically and argue his position.	P7U_U, P7S_UK	
K2_AIR_U03	Is able to formulate tasks and design and numerically study optimal decision-making and control systems.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U04	Can use measurement data to build and test system models, conduct an experimental research and use dedicated software.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U05	Defines and analyzes mathematical models of systems, use mathematical methods to design control algorithms, and is prepared to use a dedicated literature on the subject.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U06	Designs, implements and evaluates a control algorithm for a selected robotic system taking into account model inaccuracies, optionally providing robustness or adaptability.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U07	Develops an event-based automation/robotics system model, propose and implement master/distributed control algorithms.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U08	Can independently or in a team build a model of the issue, apply methods to solve the problem with artificial intelligence techniques or machine learning methods also in the field of social robots.	P7U_U, P7S_UW, P7S_UO	P7S_UW_INŻ
K2_AIR_U09	Independently or as a team-member, can design and analyze robot motion planning algorithms and model the robot's environment for use in navigation and localization of the robot in space.	P7U_U, P7S_UW, P7S_UO	P7S_UW_INŻ
K2_AIR_U10	Is able, also in a team assuming different roles in it, to design and implement a complex distributed control system using robotic development environments and libraries and rapid prototyping strategy.	P7U_U, P7S_UW, P7S_UO	P7S_UW_INŻ
K2_AIR_U11	Designs, makes, runs and tests an electronic device. Is able to select measuring equipment according to requirements imposed on the system to be designed. Can independently interpret the obtained results.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U12	Properly selects optoelectronic components for applications in industrial automation. Knows how to perform experiments in laser technology and fiber optic technology.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U13	Is able to use digital programmable circuits in digital and analog signal processing and control of automation devices. Is able to use machine learning principles in designed devices.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U14	Knows how to design circuits that match signals between the controller and programmable sensors and actuators.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_AIR_U15	Knows how to select the optimal type of communication interface for a specific application. Knows how to configure the communication interfaces used.	P7U_U, P7S_UW	P7S_UW_INŻ

Social competence

Code	Description of the directional learning outcome	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework, enabling the acquisition of engineering competences
K2_AIR_K01	Is aware of social consequences of research and development activities and the related responsibility for decisions. Understands the need to communicate information and opinions to the public regarding the achievements of technology and other aspects of the activities of a technical graduate. Understands the roles of mass media.	P7U_K, P7S_KO, P7S_KR	
K2_AIR_K02	Appreciates the role of innovation in the economy. He is ready to think and act in an entrepreneurial manner, start a business and run a small business.	P7U_K, P7S_KK, P7S_KO	
Language outcomes			
SJO_S2_U01	Be able to use a foreign language at B2+ ESCJ level and specialised terminology	P7S_UK	

Detailed information on ECTS points

Control Engineering and Robotics

Name	Embedded Robotics
Total ECTS	90
Total number of hours of classes	1110
Number of ECTS points assigned to classes related to scientific activities conducted at the university in the discipline or disciplines to which the field of study is assigned (DN)	75/90 (83.33%)
Number of ECTS points allocated to classes developing practical skills (including laboratory, project) (P)	51.8
The number of ECTS points that a student will receive by completing classes that require the direct participation of academic teachers or other persons conducting classes and students (BU)	45.8
Percentage of ECTS for elective courses	74/90 (82.22%)
The number of ECTS points that a student will receive by completing classes in the humanities or social sciences appropriate for a given field of study	5
The number of ECTS points that a student will receive by completing classes in basic sciences (mathematics, physics/chemistry)	4

Organization of studies

Implementation of the study programme

Allowable ECTS deficit

Semester	Allowable deficit of ECTS points after a semester
Semester 1	8
Semester 2	8
Semester 3	0

Detailed requirements

None.

Methods of verifying the intended learning outcomes

Activity form	Methods of verifying the intended learning outcomes
Seminar	Multimedia presentations conducted and prepared individually or in groups; case study analysis, class participation, paper
Classes	Credit - oral, written; short test, input task, evaluation of the sub-tasks; practical exam, model, essay, paper
Project	Project preparation, project implementation, project documentation, case study analysis, model
Diploma thesis	Evaluation of work in the preparation of a thesis; anti-plagiarism analysis; review
Laboratory	Preparation of laboratory reports; oral statements, class participation; short test, input task, evaluation of the sub-tasks
Lecture	Exam - oral, written, credit, test - oral, written

Description of the process leading to achieving learning outcomes

In fulfilling the curriculum, students attend organized classes. In accordance with the regulations of higher education at WUST, students are required to attend classes. Classes are conducted in the forms specified in the study regulations, using both traditional teaching methods and tools, as well as opportunities offered by the university's e-learning platform. Lectures can be conducted using modern techniques and infrastructure of the Faculty or the WUST, including synchronous remote teaching, and laboratory and project classes in team or individualized form. Seminar classes are used to broaden and deepen knowledge based mainly on their own literature studies, as well as provide an opportunity to acquire (self-) presentation skills. Outside of class hours, instructors are available to students at designated and announced on the Faculty website consultation times. An important element of learning is the student's own work, which consists of preparing for classes (based on materials provided by the instructors, as well as the recommended literature), studying the literature, preparing reports and reports, preparing for colloquia and exams. Individualization of the learning process is achieved by offering specialization classes.

Each PRK learning effect is assigned codes of subjects indicated in the study program. Passing these subjects means achieving the given effect. Subjects are passed on the basis of the forms of control of acquired knowledge, skills and social competencies, defined in the subject charters. The external form and necessary elements of the subject charter are regulated by the relevant internal regulation, and its content is developed by the subject supervisor in cooperation with his/her team. Subject charters are available on the Department's website, and the tutors should remind students of conditions for credit at the beginning of the semester. Verification and assessment of the achievement of learning outcomes varies and depends on the particular form of classes. They are carried out both by traditional methods, such as a written exam, oral exam, written colloquium, oral colloquium, test, written report/report, project,

presentation, homework, evaluation of activity during classes, or by non-standard methods in the form of self-assessment or evaluation in a student group. Failure of a student to achieve learning outcomes assigned to a course results in failure to pass the course and the need to repeat it. Successful completion of each semester of study is conditional on acquiring the number of ECTS points specified in the study program, which is equivalent to achieving the majority of the learning outcomes prescribed for the semester. Courses not passed must be repeated by the student in subsequent semesters, thus achieving the remaining learning outcomes.

Positive graduation is possible after the student has achieved all the learning outcomes stipulated in the study program. Verification and assessment of learning outcomes achieved by the student during the entire learning cycle takes place mainly at the level of individual subjects. Full coverage of the learning outcomes defined for the program of study by the learning outcomes defined (and verified) for the subjects that make up the program ensures verification of the directional outcomes (learning outcomes achieved by the student throughout the learning cycle).

The quality of instruction and the achievement of learning outcomes are monitored by the Educational Quality Assessment and Assurance Committee, whose scope of activity includes procedures for creating and modifying educational programs, individualizing study programs, implementing the teaching process and graduation. Quality control of the educational process includes evaluation of learning outcomes achieved by students. Monitoring and verification of the quality of instruction is supported by hospitalizations and surveys, carried out according to strictly defined Faculty procedures.

Internships

Diploma exam

The scope of the diploma exam includes the educational content taught in the course of study. The list of applicable diploma topics, if necessary, is updated after consultations with the academic staff teaching each subject. It is then approved by the Course Curriculum Committee and made public on the Faculty website, by the date specified in the Study Regulations.

Study plan

Control Engineering and Robotics

Semester 1

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Control Theory	Lecture: 30 Classes: 15 Laboratory: 15	Lecture: Exam Classes: Graded credit Laboratory: Graded credit	Lecture: 2 Classes: 2 Laboratory: 1	Obligatory
Physics	Lecture: 15	Graded credit	1	Obligatory
Foreign Language 2.2	Classes: 60	Graded credit	3	Obligatory group
Student/ka wybiera jeden przedmiot językowy z oferty ogólnouczelnianej				
Foreign Language 2.2	Classes: 60	Graded credit	3	Elective
Sum	135		9	

Specialty: Embedded Robotics

A peculiarity of the English-language Embedded Robotics specialization, unlike Polish-language specializations, is that it is recruited at the beginning of the first semester. The second major difference is the implementation of the directional subjects of Automation and Robotics in the first two semesters instead of only the first semester. In the first semester, the first of the directional education subjects from the canon of automation and robotics, covering control theory, is implemented. Specialized semester subjects deal with methods of artificial intelligence and machine learning supported by foundations in formal logic and embedded systems also in the version of development environments for these systems. Of the general-polytechnic subjects, physics and the first foreign language are implemented.

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Robotic Programming Environments	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 3 Laboratory: 2	Obligatory in specialty
Artificial Intelligence and Machine Learning	Lecture: 30 Project: 30	Lecture: Graded credit Project: Graded credit	Lecture: 2 Project: 2	Obligatory in specialty
Embedded Systems	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Obligatory in specialty

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Applied Logic	Lecture: 30 Classes: 15	Lecture: Graded credit Classes: Graded credit	Lecture: 2 Classes: 1	Obligatory in specialty
Sensors and Actuators	Lecture: 15 Laboratory: 15	Lecture: Graded credit Laboratory: Graded credit	Lecture: 1 Laboratory: 2	Obligatory in specialty
Sum	255		19	

Semester 2

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Applications of AI Models in Automation	Lecture: 30 Project: 30	Lecture: Exam Project: Graded credit	Lecture: 2 Project: 2	Obligatory
Foreign Language 2.1	Classes: 30	Graded credit	2	Obligatory group
Student/ka wybiera jeden przedmiot językowy z oferty ogólnouczeniowej				
Foreign Language 2.1	Classes: 30	Graded credit	2	Elective
Sum	90		6	

Specialty: Embedded Robotics

In the second semester, the remaining directional subjects are implemented: modeling and identification, optimization methods, and applications of AI methods in automation. The knowledge and skills of sensors and their systems are expanded, and aspects of robotics at the higher level: discrete and lower level: control of embedded systems are presented. In a number of projects and laboratories, the student has the opportunity to learn about the practical aspects of stationary and mobile robotics, and through the realisation of an intermediate project also acquire or consolidate the ability to work in a group on a complex robotic task. A second foreign language is implemented during this semester.

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Event-Based Control	Lecture: 15 Classes: 15 Project: 30	Lecture: Graded credit Classes: Graded credit Project: Graded credit	Lecture: 2 Classes: 1 Project: 2	Obligatory in specialty
Control Theory for Embedded Systems	Lecture: 15 Laboratory: 15	Lecture: Graded credit Laboratory: Graded credit	Lecture: 1 Laboratory: 1	Obligatory in specialty
Mobile Robotics	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 3 Laboratory: 2	Obligatory in specialty

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Intermediate Project	Project: 30	Graded credit	3	Obligatory in specialty
Theory and Methods of Optimization	Lecture: 30 Classes: 15	Lecture: Graded credit Classes: Graded credit	Lecture: 2 Classes: 2	Obligatory in specialty
Modeling and Identification	Lecture: 30 Classes: 15	Lecture: Graded credit Classes: Graded credit	Lecture: 2 Classes: 1	Obligatory in specialty
Specialization Seminar	Seminar: 30	Graded credit	2	Obligatory in specialty
Sum	300		24	

Semester 3

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Entrepreneurship	Lecture: 15 Seminar: 15	Lecture: Graded credit Seminar: Graded credit	Lecture: 1 Seminar: 1	Obligatory
Developing Managerial Skills	Lecture: 15 Seminar: 15	Lecture: Graded credit Seminar: Graded credit	Lecture: 1 Seminar: 1	Obligatory
Smart Factory	Lecture: 15	Graded credit	1	Obligatory
Ethics of New Technologies	Seminar: 15	Graded credit	1	Obligatory
Sum	90		6	

Specialty: Embedded Robotics

In semester three, the student deepens knowledge and skills in advanced methods of control and motion planning of robotic systems, including social robots. The main semester task is to prepare a thesis selected from the available pool of topics at the end of semester two. The progress of the thesis is monitored on an ongoing basis in the diploma seminar. Knowledge of entrepreneurship and social communication is also supplemented.

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Advanced Robot Control	Lecture: 30 Laboratory: 15	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 1	Obligatory in specialty
Task and Motion Planning	Lecture: 30 Seminar: 15	Lecture: Graded credit Seminar: Graded credit	Lecture: 2 Seminar: 1	Obligatory in specialty

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Social Robots	Lecture: 15 Laboratory: 15	Lecture: Graded credit Laboratory: Graded credit	Lecture: 1 Laboratory: 1	Obligatory in specialty
Master Thesis	Diploma thesis: 90	Graded credit	15	Obligatory in specialty
Diploma Seminar	Seminar: 30	Graded credit	3	Obligatory in specialty
Sum	240		26	

Syllabuses



Robotic Programming Environments
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 1	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 3 ECTS, Exam• Laboratory: 30 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Differentiates and explains methods for designing component-oriented systems.	K2_AIR_W10
PEU_W02	Explains methods for designing distributed control systems.	K2_AIR_W10
PEU_W03	Defines and explains communication protocols.	K2_AIR_W10
PEU_W04	Characterizes selected robotic programming environments.	K2_AIR_W10
PEU_W05	Classifies and describes selected robotic programming environments.	K2_AIR_W10
PEU_W06	Differentiates and characterizes selected programming libraries supporting the development of control systems.	K2_AIR_W10
In terms of skills		

PEU_U01	Designs and implements distributed heterogeneous control systems.	K2_AIR_U10
PEU_U02	Analyzes, decomposes, and defines complex systems, components, and interfaces.	K2_AIR_U10
PEU_U03	Selects and utilizes available programming environments to implement complex distributed control systems.	K2_AIR_U10
PEU_U04	Selects and utilizes available simulation environments for modeling robots and their environments.	K2_AIR_U10
PEU_U05	Utilizes available programming libraries for solving differential equations, optimization, and control.	K2_AIR_U10

Program content ensuring learning outcomes

The course program covers theory and practice related to robotic programming environments and distributed control systems. Students will familiarize themselves with component-based design methods, communication protocols, and selected programming environments used in robotics, with a focus on the ROS 2 environment.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Self-study of class topics	11
Preparation for classes	10
Preparation for an exam/credit	10
Credit/Exam	4
Preparation of a report/summary/presentation/paper	30
Student workload	Hours 125



Control Theory
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality -	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory
Study form full-time studies	Block Major-specific subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 1	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 2 ECTS, Exam• Classes: 15 h, 2 ECTS, Graded credit• Laboratory: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Explains the structure, representation and relevant properties of model-based non-linear feedback control systems.	K2_AIR_W06
PEU_W02	Characterises control tasks and associated model-based control algorithms.	K2_AIR_W06
In terms of skills		
PEU_U01	Is able to analyze selected properties of non-linear control systems and perform the calculations necessary to synthesize and analyze control algorithms for such systems, both theoretically and with the help of a software environment for engineering and scientific calculations.	K2_AIR_U06

Program content ensuring learning outcomes

The lecture is devoted to the presentation and discussion of the representation of a nonlinear dynamic system with state variables, stability, feedback linearization and optimal control.

Exercises are aimed at acquiring skills in stability testing, synthesis of control algorithms based on feedback linearization and optimal control algorithms for simple cases.

The laboratory aims to acquire skills in stability testing, synthesis of control algorithms based on feedback linearisation and optimal control algorithms for complex cases, based on professional scientific and engineering computing software.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	15
Self-study of class topics	11
Credit/Exam	4
Preparaton for classes	11
Preparation for an exam/credit	12
Laboratory	15
Conducting empirical studies	15
Preparation of a report/summary/presentation/paper	12
Student workload	Hours 125



Artificial Intelligence and Machine Learning
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics Speciality Embedded Robotics Organizational unit Faculty of Electronics, Photonics and Microsystems Study level second degree 3 semesters Study form full-time studies Education profile general academic profile	Education cycle 2025/2026 Subject code Lecture languages English Mandatoriness Obligatory in specialty Block Specialty subjects Subject related to scientific research Yes
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Semester Semester 1	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 2 ECTS, Graded credit• Project: 30 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Understands the concept of artificial intelligence, knowledge representation, and reasoning.	K2_AIR_W08
PEU_W02	Knows the search methods for different classes of problems, and the use of heuristics in problem solving.	K2_AIR_W08
PEU_W03	Understands the application of mathematical logic to problem representation, and the importance of uncertainty.	K2_AIR_W08
PEU_W04	Understands the application of probability to problem description, the bayesian networks, the Markov decision processes, and the basic algorithms for solving them.	K2_AIR_W08
In terms of skills		
PEU_U01	Can create abstract descriptions of practical problems and implement algorithms to solve them.	K2_AIR_U08

Program content ensuring learning outcomes

1. General understanding of the knowledge representation, reasoning, and machine learning issues.
2. Learn about using heuristics and their use in problem solving.
3. Learn about using logic and theorem proving in reasoning.
4. Learn about using probability, the Bayes rule, utilities, and Markov processes algorithms for single and sequential decision making.
5. Learn about the induction (supervised and unsupervised) and reinforcement learning methods.
6. Gain a practical ability to use one of the existing formal paradigms to build abstract representation of practical problems, and solve them.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Project	30
Self-study of class topics	5
Preparation of a project	25
Preparaton for classes	10
Student workload	Hours 100



Physics
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality -	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory
Study form full-time studies	Block Subjects of basic education - physics
Education profile general academic profile	

Semester Semester 1	Activities, hours, ECTS and examination • Lecture: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Explains what corpuscular-wave duality.	K2_AIR_W01
PEU_W02	Presents the postulates and basic formalism of quantum mechanics.	K2_AIR_W01
PEU_W03	Explains the physical meaning of Schroedinger's equation and the wave function.	K2_AIR_W01
PEU_W04	Explains the physical meaning of the solution of Schroedinger's equation for the hydrogen atom and multi-electron atoms.	K2_AIR_W01
PEU_W05	Characteirizes the ideas of quantum description of multi-atomic systems, in particular the band structure of crystals.	K2_AIR_W01
PEU_W06	Describes the principle of operation of modern selected semiconductor devices.	K2_AIR_W01

Program content ensuring learning outcomes

Selected fundamental laws of modern physics necessary to understand physical phenomena within the scientific discipline studied

Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Preparaton for classes	4
Preparation for an exam/credit	6
Student workload	Hours 25



Embedded Systems Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 1	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 2 ECTS, Graded credit• Laboratory: 30 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Describes the design principles of digital programmable circuits. The student selects an FPGA in terms of required performance and offered peripherals for a given application.	K2_AIR_W10
PEU_W02	Explains the principles of construction and applications of embedded systems. Describes multicore processors and the idea and operation of parallel processing.	K2_AIR_W10
In terms of skills		
PEU_U01	Uses information provided in technical notes in the design process of embedded systems. The student uses computer tools to support the design and testing of software for a selected hardware platform.	K2_AIR_U10
PEU_U02	Develops software in HDL languages using the building blocks of FPGAs.	K2_AIR_U10

Program content ensuring learning outcomes

Students improve their knowledge and skills in modern single-chip and multi-core microcontrollers. They learn about the use of various intermediate peripheral circuits in particular those required for Internet of Things and Neural Networks or Artificial Intelligence applications. Students are introduced to the idea of parallel processing on multi-core homogeneous and heterogeneous processors. In the final phase of the course, students improve their knowledge and skills in using programmable logic structures in the implementation of signal processing algorithms. They learn about the main structures, parameters and applications, and acquire knowledge of the basics of HVL languages and their use to create a variety of combinational and sequential circuits.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for classes	5
Preparation for an exam/credit	10
Preparation of a report/summary/presentation/paper	19
Conducting literature research	6
Student workload	Hours 100



Foreign Language 2.2
Educational subject description sheet

Basic information

Field of study lektoraty	Education cycle 2025/2026
Speciality -	Subject code SJO000-25SM02690C
Organizational unit Wrocław University of Science and Technology	Lecture languages English
Study level second degree	Mandatoriness Elective
Study form full-time studies	Block Foreign languages
Education profile general academic profile	

Semesters Semester 1, Semester 2, Semester 3	Activities, hours, ECTS and examination • Classes: 60 h, 3 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Student has knowledge, skills and competences consistent with the requirements specified for the appropriate language level; knows, understands and uses linguistic means (grammatical, lexical and stylistic) defined at a certain level from everyday life with selected elements of academic, specialist and technical language used in the field of study and in the academic and professional environment; communicates in a family, social and intercultural environment, practicing communication skills; appreciates the need to improve their skills in effective communication, develops competences in the area of communication language, basics of specialist and academic language	SJO_S2_U01

Program content ensuring learning outcomes

A1; A2; B1 French, Spanish, Japanese, German, Polish as a foreign language, Russian

General educational content

Formation and deepening of communicative competence in a family, social and intercultural environment and for a specific level for academic and professional needs.

Interaction appropriate to the appropriate level of language competence, e.g., the student's own profile and interests; presenting oneself, one's interests and ideas in environmental, academic and professional contexts. Developing creative, receptive and interactive competence in a group.

Language in communication in the modern world. Verbal and non-verbal communication - sensitivity to cultural differences, starting a conversation, joining in a discussion, moving on to the next points, summarizing statements, using characteristic phrases and expressions for a certain language level; taking part in various forms of interaction.

Calculation of ECTS points

Activity form	Activity hours
Classes	60
Preparaton for classes	30
Student workload	Hours 90



Applied Logic
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Subjects of basic education - mathematics
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 1	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 2 ECTS, Graded credit• Classes: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Presents and explains the method of resolution in the Sentence Calculus.	K2_AIR_W01
PEU_W02	Explains the concepts and justifies the properties of LTL logic.	K2_AIR_W01
PEU_W03	Describes the concept of Buchi's automaton and its relation to LTL sentences.	K2_AIR_W01
PEU_W04	Formulates the properties of a discrete state system using modal logic.	K2_AIR_W01
In terms of skills		
PEU_U01	Proves that a sentence is a tautology of modal logic LTL.	K2_AIR_U02
PEU_U02	Constructs Buchi automata for a given LTL sentence.	K2_AIR_U02

PEU_U03	Describes the properties of protocols using LTL logic sentences.	K2_AIR_U02
PEU_U04	Models the protocols using the Spin tool.	K2_AIR_U02

Program content ensuring learning outcomes

Deepening the knowledge of classical sentence calculus. Presentation of modal logics with special emphasis on LTL. To define Buchi automata and to show the connection with LTL logic and automatic verification.

To acquire basic skills in the use of modal logic methods, LTL and Buchi automata.

To become familiar with tools for automatic verification: the Promela language and the Spin interpreter.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	15
Preparaton for classes	15
Preparation of a report/summary/presentation/paper	6
Self-study of class topics	5
Preparation for an exam/credit	4
Student workload	Hours 75



Sensors and Actuators
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 1	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 15 h, 1 ECTS, Graded credit• Laboratory: 15 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Characterizes the purposes of using sensors and actuators in specific applications.	K2_AIR_W14
PEU_W02	Explains the physical principles of the basic sensors and actuators used in robotics.	K2_AIR_W14
PEU_W03	Describes the design of basic sensors and actuators used in robotics.	K2_AIR_W14
In terms of skills		
PEU_U01	Interprets data obtained from basic sensors used in robotics.	K2_AIR_U14

Program content ensuring learning outcomes

Acquire knowledge of the design and principles of operation of basic sensors used in robotics and their use, as well as the basic systems used in measurement systems. Acquire the ability to interpret data obtained from these sensors.

Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Laboratory	15
Preparation for classes	15
Preparation of a report/summary/presentation/paper	20
Self-study of class topics	10
Student workload	Hours 75



Applications of AI Models in Automation
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics Speciality - Organizational unit Faculty of Electronics, Photonics and Microsystems Study level second degree 3 semesters Study form full-time studies Education profile general academic profile	Education cycle 2025/2026 Subject code Lecture languages English Mandatoriness Obligatory Block Major-specific subjects Subject related to scientific research Yes
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Semester Semester 2	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 2 ECTS, Exam• Project: 30 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Categorizes and describes the main paradigms of knowledge representation methods, artificial intelligence algorithms and machine learning.	K2_AIR_W08
PEU_W02	Discusses applications of knowledge representation methods, artificial intelligence algorithms and machine learning.	K2_AIR_W08
In terms of skills		
PEU_U01	Classifies artificial intelligence methods and selects machine learning models appropriate to the task.	K2_AIR_U08
PEU_U02	Implements artificial intelligence methods for application in selected tasks, including those related to automation and robotics.	K2_AIR_U08

Program content ensuring learning outcomes

The subject includes acquiring knowledge by students in the field of data analysis and the basics of artificial intelligence methods, in particular artificial neural networks used in solving problems in the field of electronics, automation and robotics, as well as decision support systems dedicated to various fields of science.

As a result of completing the subject, students will acquire skills in data analysis, feature extraction and selection, and selection, implementation and verification of artificial intelligence methods.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Project	30
Self-study of class topics	5
Preparation of a project	26
Preparation of a report/summary/presentation/paper	5
Credit/Exam	4
Student workload	Hours 100



Event-Based Control
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 2	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 15 h, 2 ECTS, Graded credit• Project: 30 h, 2 ECTS, Graded credit• Classes: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Characterizes formalisms for modeling Discrete Event Systems (DES), including Petri nets and finite state-automata.	K2_AIR_W07
PEU_W02	Defines concepts related to the synthesis of supervisory control based on DES models and identifies their applications in selected automation and robotics systems.	K2_AIR_W07
In terms of skills		
PEU_U01	Designs DES models of complex systems and develops supervisory control for them.	K2_AIR_U05
PEU_U02	Analyzes the operation and examines the properties of automaton-based and network-based modeling of automation/robotic systems.	K2_AIR_U05

Program content ensuring learning outcomes

Acquirement of the knowledge of the Discrete Event System (DES) theory and its applications, including the concepts of formal languages, finite state automata, and Petri nets. Acquirement of the ability to apply the theory of DES in the modeling of robotics and automation systems as well as the design and development of the supervisory control.

Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Project	30
Self-study of class topics	11
Preparation of a project	15
Preparation of a report/summary/presentation/paper	9
Preparation for an exam/credit	10
Classes	15
Preparaton for classes	20
Student workload	Hours 125



Control Theory for Embedded Systems
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 2	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 15 h, 1 ECTS, Graded credit• Laboratory: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Characterises the fundamental topics of feedback theory, in particular: basic feedback configurations and their properties, stability, stability robustness, feedback loop design, classical control objectives and behavioural criteria, classical compensator design methods (such as lead/lag compensation, elemental line method, Guillemin-Truxal method);	K2_AIR_W03
PEU_W02	Characterises the general scheme of an adaptive system and the basic mathematical apparatus used to analyse adaptive systems.	K2_AIR_W03

PEU_W03	Characterises the impact of software properties on the implementation of mathematical control laws on a hardware unit, the basic steps of control law implementation and verification (according to the V-model) that are supported by Matlab/Simulink software, in particular: simulation, rapid prototyping of controllers, rapid prototyping using a target unit, Software-in-the-Loop, Processor-in-the-Loop, Hardware-in-the-Loop.	K2_AIR_W10
In terms of skills		
PEU_U01	Designs and analyses a control system based on a feedback architecture based on the robust control and adaptive control paradigms.	K2_AIR_U06

Program content ensuring learning outcomes

Lecture: classical control system design methods, methods for the analysis and design of adaptive control systems, and computer tools and techniques for the implementation of model-based control algorithms are discussed.

Laboratory: the ability to implement and analyse robust and adaptive control algorithms using a hardware and software environment for rapid prototyping of controllers is acquired through empirical studies,

Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Laboratory	15
Credit/Exam	4
Preparaton for classes	5
Preparation of a report/summary/presentation/paper	11
Student workload	Hours 50



Foreign Language 2.1
Educational subject description sheet

Basic information

Field of study lektoraty	Education cycle 2025/2026
Speciality -	Subject code SJO000-25SM02684C
Organizational unit Wrocław University of Science and Technology	Lecture languages English
Study level second degree	Mandatoriness Elective
Study form full-time studies	Block Foreign languages
Education profile general academic profile	

Semesters Semester 1, Semester 2, Semester 3	Activities, hours, ECTS and examination • Classes: 30 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Student has knowledge, skills and competences consistent with the requirements specified for the minimum B2 level according to the Common European Framework of Reference for Languages; knows, understands and uses linguistic means (grammatical, lexical and stylistic) from academic, specialist and technical languages used in the field of study and in the academic and professional environment; communicates in an intercultural and professional environment; understands and has the ability to analyze foreign-language specialist texts; improves their skills in the area of specialized and academic languages.	SJO_S2_U01

Program content ensuring learning outcomes

B2 plus English, French, Spanish, German C1 plus English language General educational content

Formation and deepening of communicative competence in academic and professional settings.
 Interaction appropriate to the appropriate level of linguistic competence, such as the student's own profile for academic and professional purposes. Deepening creative, receptive and interactive competence in a team.
 Language in communication in specialized and professional fields in the modern world. Verbal and non-verbal communication - functioning freely in an intercultural environment, conducting discourse, polemics, analysis of specialized texts.

Calculation of ECTS points

Activity form	Activity hours
Classes	30
Preparaton for classes	30
Student workload	Hours 60



Mobile Robotics
Educational subject description sheet

Basic information

<p>Field of study Control Engineering and Robotics</p> <p>Speciality Embedded Robotics</p> <p>Organizational unit Faculty of Electronics, Photonics and Microsystems</p> <p>Study level second degree 3 semesters</p> <p>Study form full-time studies</p> <p>Education profile general academic profile</p>	<p>Education cycle 2025/2026</p> <p>Subject code</p> <p>Lecture languages English</p> <p>Mandatoriness Obligatory in specialty</p> <p>Block Specialty subjects</p> <p>Subject related to scientific research Yes</p>
<p>Semester Semester 2</p>	<p>Activities, hours, ECTS and examination</p> <ul style="list-style-type: none">• Lecture: 30 h, 3 ECTS, Exam• Laboratory: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Names and characterizes basic problems and methods of mobile robotics.	K2_AIR_W09
PEU_W02	Characterizes and explains tasks of mobile robot localization, map building methods, SLAM. Distinguishes and explains algorithms related to them.	K2_AIR_W09
In terms of skills		
PEU_U01	Designs a navigation system for a mobile robot. Solves the problem of self-localization of a mobile robot using robot sensors.	K2_AIR_U09
PEU_U02	Develops and implements an algorithm for creating a map of the environment by a mobile robot and uses the map of the environment for robot navigation.	K2_AIR_U09

Program content ensuring learning outcomes

The course aims to familiarize students with the main problems of mobile robotics, along with methods of solving them using the probabilistic approach. The program covers topics of robot localization, mapping, SLAM and integration of the robot navigation system. The theoretical aspects presented in the lecture are complemented by the acquisition of practical skills during tasks carried out in laboratory classes. After completing the course, students will know the key terminology and the main directions of current research in mobile robotics, they will also gain practical skills in designing and implementing navigation systems of wheeled mobile robots.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Credit/Exam	4
Preparation for an exam/credit	10
Self-study of class topics	7
Preparation for classes	14
Preparation of a report/summary/presentation/paper	30
Student workload	Hours 125



Intermediate Project Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	

Semester Semester 2	Activities, hours, ECTS and examination • Project: 30 h, 3 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Can research the technical literature for the given problem.	K2_AIR_U08, K2_AIR_U09, K2_AIR_U10
PEU_U02	Can state the goals, scope, requirements and time schedule for a project.	K2_AIR_U08, K2_AIR_U09, K2_AIR_U10
PEU_U03	Can creatively implement a project in the broad area of embedded robotics.	K2_AIR_U08, K2_AIR_U09, K2_AIR_U10
PEU_U04	Can document and present project results.	K2_AIR_U08, K2_AIR_U09, K2_AIR_U10

Program content ensuring learning outcomes

1. Developing skills for researching and constructively analyzing the available literature.

2. Developing skills for formulating the goals, scope, requirements, and time schedule of the project.
3. Developing skills for designing the abstract architecture of the system.
4. Developing skills for writing and presenting the project documentation.

Calculation of ECTS points

Activity form	Activity hours
Project	30
Conducting literature research	5
Preparation of a project	35
Preparation of a report/summary/presentation/paper	5
Student workload	Hours 75



Theory and Methods of Optimization
Educational subject description sheet

Basic information

<p>Field of study Control Engineering and Robotics</p> <p>Speciality Embedded Robotics</p> <p>Organizational unit Faculty of Electronics, Photonics and Microsystems</p> <p>Study level second degree 3 semesters</p> <p>Study form full-time studies</p> <p>Education profile general academic profile</p>	<p>Education cycle 2025/2026</p> <p>Subject code</p> <p>Lecture languages English</p> <p>Mandatoriness Obligatory in specialty</p> <p>Block Specialty subjects</p> <p>Subject related to scientific research Yes</p>
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<p>Semester Semester 2</p>	<p>Activities, hours, ECTS and examination</p> <ul style="list-style-type: none"> • Lecture: 30 h, 2 ECTS, Graded credit • Classes: 15 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Identifies analytic methods of multi-variable optimization and knows the conditions of optimality.	K2_AIR_W03
PEU_W02	Chooses appropriate numerical methods of local optimization dedicated for specific static optimization problems with and without constraints.	K2_AIR_W03
PEU_W03	Formulates appropriate heuristic algorithms, dedicated for specific problems of static optimization.	K2_AIR_W03
In terms of skills		
PEU_U01	Applies accurate and approximate algorithms to solve the tasks of static optimization with or without constraints.	K2_AIR_U03
PEU_U02	Chooses accurate and approximate algorithms to solve continuous and discrete optimization problems.	K2_AIR_U03

PEU_U03	The student can select suitable parameters for the selected standard optimization methods.	K2_AIR_U03
PEU_U04	Interprets the meaning of the obtained solution for the specific problems of control theory and robotics.	K2_AIR_U03

Program content ensuring learning outcomes

The aim of the course is to learn the optimization theory. The student will get to know the necessary and sufficient optimality conditions for problems without and with constraints and learn about numerical methods of solving such problems. Linear programming and integer programming tools will be presented. Then, gradient methods for solving unconstrained optimization problems and their generalizations allowing solving constrained optimization problems will be introduced. Finally, most popular heuristic optimization methods will be discussed.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	15
Preparation for classes	15
Preparation of a project	15
Self-development of practical skills	15
Preparation for an exam/credit	10
Student workload	Hours 100



Modeling and Identification
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 2	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 2 ECTS, Graded credit• Classes: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Explains methods of computer modeling of random environments and names and defines methods of random number generation.	K2_AIR_W04
PEU_W02	Characterizes parametric and non-parametric methods for synthesizing linear models of dynamic objects from uncertain data.	K2_AIR_W04
PEU_W03	Describes computer implementations of typical system identification methods and selected methods for Hammerstein and Wiener systems.	K2_AIR_W04
In terms of skills		
PEU_U01	Knows how to propose a model of a (non-)linear object.	K2_AIR_U04
PEU_U02	Analytically calculate and study selected properties of models.	K2_AIR_U04

Program content ensuring learning outcomes

Gain knowledge of pseudorandom number generation methods, the estimation theory and estimator quality assessment. To learn methods of estimation and identification of selected classes of dynamic objects. To acquire the ability to analytically derive models for selected classes.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	15
Self-study of class topics	5
Preparation for an exam/credit	10
Preparaton for classes	15
Student workload	Hours 75



Specialization Seminar
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 2	Activities, hours, ECTS and examination • Seminar: 30 h, 2 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Is able to prepare and present a scientific/technical seminar using traditional and electronic resources.	K2_AIR_U02
PEU_U02	Is able to lead and participate in a scientific/technical discussion.	K2_AIR_U02

Program content ensuring learning outcomes

1. Acquisition of knowledge on selected recent developments in the specific area of Embedded Robotics as well as in the broader area of Control Engineering and Robotics
2. Development of the skills to study technical literature, make a synthesis of collected information, and prepare and deliver a comprehensible seminar in the field
3. Development of the skills to prepare and present seminar
4. Development of the skills to participate constructively in a scientific/technical discussion

Calculation of ECTS points

Activity form	Activity hours
Seminar	30
Conducting literature research	8
Preparation of a report/summary/presentation/paper	12
Student workload	Hours 50



Entrepreneurship
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality -	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory
Study form full-time studies	Block Subjects from the fields of humanities or social sciences
Education profile general academic profile	

Semester Semester 3	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 15 h, 1 ECTS, Graded credit• Seminar: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Identifies the process of creating and developing individual and organizational entrepreneurship based on intellectual property resources.	K2_AIR_W02
In terms of social competences		
PEU_K01	Solves problems in an innovative and entrepreneurial way and uses creating develop innovative companies.	K2_AIR_K02

Program content ensuring learning outcomes

The program content includes knowledge from the area of entrepreneurship, in particular knowledge about the development and use of entrepreneurial skills to create innovative ventures. They allow you to gain knowledge about strategies, models, and methods as instruments for building an enterprise focused on the development of innovation.

Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Seminar	15
Preparation of a project	10
Self-study of class topics	10
Student workload	Hours 50



Developing Managerial Skills
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality -	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory
Study form full-time studies	Block Subjects from the fields of humanities or social sciences
Education profile general academic profile	

Semester Semester 3	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 15 h, 1 ECTS, Graded credit• Seminar: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Recognizes the main regularities of operation in managerial work and optimization of work efficiency.	K2_AIR_W02
In terms of social competences		
PEU_K01	Is capable of improving his own and subordinates' competencies and using them in effective organizational management.	K2_AIR_K02

Program content ensuring learning outcomes

The course is designed to deepen knowledge and develop skills for effective managerial work in managing teams, communicating with employees, motivating work, time management, developing employee potential.

Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Seminar	15
Preparation of a report/summary/presentation/paper	7
Preparation for classes	7
Preparation for an exam/credit	6
Student workload	Hours 50



Advanced Robot Control Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 3	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 30 h, 2 ECTS, Graded credit• Laboratory: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Student is able to select and characterize usage of selected algorithms for robotic control systems.	K2_AIR_W09
PEU_W02	Describes operation of embedded systems in robotic environments.	K2_AIR_W10
In terms of skills		
PEU_U01	Is able to implement selected algorithms for robot control.	K2_AIR_U06

Program content ensuring learning outcomes

Gains knowledge about selected control algorithms for robotic and embedded systems. Gains design and implementation skills in relation to control algorithms of robotics systems with particular consideration for embedded systems.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	15
Preparaton for classes	10
Preparation for an exam/credit	5
Preparation of a report/summary/presentation/paper	15
Student workload	Hours 75



Task and Motion Planning Educational subject description sheet

Basic information

<p>Field of study Control Engineering and Robotics</p> <p>Speciality Embedded Robotics</p> <p>Organizational unit Faculty of Electronics, Photonics and Microsystems</p> <p>Study level second degree 3 semesters</p> <p>Study form full-time studies</p> <p>Education profile general academic profile</p>	<p>Education cycle 2025/2026</p> <p>Subject code</p> <p>Lecture languages English</p> <p>Mandatoriness Obligatory in specialty</p> <p>Block Specialty subjects</p> <p>Subject related to scientific research Yes</p>
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<p>Semester Semester 3</p>	<p>Activities, hours, ECTS and examination</p> <ul style="list-style-type: none"> • Lecture: 30 h, 2 ECTS, Graded credit • Seminar: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Using the correct terminology, lists the components and defines motion planning tasks.	K2_AIR_W09
PEU_W02	Characterizes the methods and describes the underlying motion planning algorithms for diverse robot models operating in different environments.	K2_AIR_W09
In terms of skills		
PEU_U01	Classifies and locates motion planning tasks among other classical tasks of robotics.	K2_AIR_U09
PEU_U02	Selects a method for a given motion planning task using properties of the model and desired properties of the solution.	K2_AIR_U09

Program content ensuring learning outcomes

The objectives are:

- to acquire knowledge of the factors affecting the formulation and solution of planning tasks,
- acquiring the ability to properly select a method for a given task,
- acquiring knowledge of selected motion planning methods for different environments and robot models,
- acquiring advanced knowledge, using the robotic literature, on applications of task and motion planning methods.

Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Seminar	15
Conducting literature research	5
Preparation of a report/summary/presentation/paper	25
Student workload	Hours 75



Smart Factory
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality -	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory
Study form full-time studies	Block Major-specific subjects
Education profile general academic profile	

Semester Semester 3	Activities, hours, ECTS and examination • Lecture: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Elaborates about trends and modern technologies in production environments and automation and robotics devices.	K2_AIR_W10

Program content ensuring learning outcomes

The aim of the subject in terms of knowledge is to become familiar with issues related to technologies used in smart factories.

Calculation of ECTS points

Activity form	Activity hours
Lecture	15

Self-study of class topics	2
Conducting literature research	4
Preparation of a report/summary/presentation/paper	4
Student workload	Hours 25



Social Robots
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 3	Activities, hours, ECTS and examination <ul style="list-style-type: none">• Lecture: 15 h, 1 ECTS, Graded credit• Laboratory: 15 h, 1 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Characterises the fundamental properties of a social robot, in particular a socially intelligent agent and realisation, and describes human-robot interactions.	K2_AIR_W08
In terms of skills		
PEU_U01	Operates the NAO humanoid robot and designs and implements robot-human interaction scenarios involving the NAO robot.	K2_AIR_U08

Program content ensuring learning outcomes

The lecture is dedicated to the presentation and discussion of the fundamental components of a social robot and selected issues in human-robot social interaction.

The laboratory is devoted to learning about the humanoid robot NAO and implementing human-robot social interaction scenarios.

Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Laboratory	15
Self-study of class topics	8
Credit/Exam	2
Preparation of a project	7
Preparation of a report/summary/presentation/paper	3
Student workload	Hours 50



Master Thesis
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 3	Activities, hours, ECTS and examination • Diploma thesis: 90 h, 15 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Independently carries out literature studies and, in consultation with the supervisor, completes a master's thesis that also includes research aspects (depending on its nature: analyzes, designs, constructs, calculates, selects components correctly, tests) using appropriate tools.	K2_AIR_U01
PEU_U02	Prepares a master's thesis in the field of broadly understood robotics, respecting ethical standards.	K2_AIR_U01
In terms of social competences		
PEU_K01	Declares compliance with ethical standards and cares about the research quality of the work.	K2_AIR_K01, K2_AIR_K02

Program content ensuring learning outcomes

1. Independently conducting literature studies, and on their basis, carrying out the assigned task under the supervision of a supervisor.
2. Writing a diploma thesis.
3. Preparation for taking up professional work in a broad area of tasks related to the field of study, requiring competence and both independence and teamwork skills.

Calculation of ECTS points

Activity form	Activity hours
Diploma thesis	90
Conducting literature research	30
Preparation of the thesis	195
Conducting empirical studies	45
Praca z opiekunem nad częścią merytoryczną pracy	15
Student workload	Hours 375



Diploma Seminar
Educational subject description sheet

Basic information

Field of study Control Engineering and Robotics	Education cycle 2025/2026
Speciality Embedded Robotics	Subject code
Organizational unit Faculty of Electronics, Photonics and Microsystems	Lecture languages English
Study level second degree 3 semesters	Mandatoriness Obligatory in specialty
Study form full-time studies	Block Specialty subjects
Education profile general academic profile	Subject related to scientific research Yes

Semester Semester 3	Activities, hours, ECTS and examination • Seminar: 30 h, 3 ECTS, Graded credit
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Prepares a multimedia presentation of their own achievements	K2_AIR_U02
PEU_U02	Argues in favor of their ideas and solutions.	K2_AIR_U02
PEU_U03	Is able able to critically evaluate their own and others' achievements.	K2_AIR_U02
In terms of social competences		
PEU_K01	Defends his own views and is aware of the ethical and legal aspects of research activities.	K2_AIR_K01, K2_AIR_K02

Program content ensuring learning outcomes

1. Developing the ability to use a variety of sources of knowledge appropriate to the research endeavors undertaken
2. Developing the ability to prepare presentations that present ideas, concepts and research results in a clear manner

3. Developing skills of scientific discussion and argumentation
4. Developing skills of presenting own achievements

Calculation of ECTS points

Activity form	Activity hours
Seminar	30
Preparaton for classes	25
Preparation of a report/summary/presentation/paper	20
Student workload	Hours 75



Ethics of New Technologies
Educational subject description sheet

Basic information

<p>Field of study Control Engineering and Robotics</p> <p>Speciality -</p> <p>Organizational unit Faculty of Electronics, Photonics and Microsystems</p> <p>Study level second degree 3 semesters</p> <p>Study form full-time studies</p> <p>Education profile general academic profile</p>	<p>Education cycle 2025/2026</p> <p>Subject code</p> <p>Lecture languages English</p> <p>Mandatoriness Obligatory</p> <p>Block Subjects from the fields of humanities or social sciences</p>
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<p>Semester Semester 3</p>	<p>Activities, hours, ECTS and examination • Seminar: 15 h, 1 ECTS, Graded credit</p>
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Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Analyzes and formulates arguments based on sources, so to take part in a topical discussion or communicate to a wider audience.	K2_AIR_U02
In terms of social competences		
PEU_K01	Respects the principles of ethical, social and legal responsibility for the consequences of engineering activities and is able to interpret these principles based on the ethics of new technologies.	K2_AIR_K01
PEU_K02	Appreciates the moral value of innovation and the importance of moral dilemmas involved in the related to new technologies in a professional and social context.	K2_AIR_K02

Program content ensuring learning outcomes

The subject explains core ethical concepts and theories and explains the moral significance of innovation and new

technologies.

The programme content includes: structure of the ethical dilemma, new ethical approaches to technology (roboethics, neuroethics), theoretical principles and practical aspects of technology assessment, ethical and social consequences of engineering and technical activities, the principle of responsibility. Structured assignments develop the ability to use sources, formulate critical judgements and communicate results to a wider audience.

Calculation of ECTS points

Activity form	Activity hours
Seminar	15
Preparaton for classes	3
Preparation for an exam/credit	4
Self-study of class topics	3
Student workload	Hours 25