Wrocław University of Science and Technology

Study programme

Organizational unit:	Faculty of Electronics, Photonics and Microsystems
Field of study:	elektronika w języku angielskim
Level of study:	second degree 3 semesters
Form of study:	full-time studies
Education cycle:	2026/2027

Table of contents

Field of study characteristics

Basic information

Organizational unit:	Faculty of Electronics, Photonics and Microsystems
Field of study:	elektronika w języku angielskim
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:	2026/2027
Number of semesters:	3
Total number of hours of classes:	directional: 435 Advanced Applied Electronics: 675
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 master’s degree program in Electronics, offered by the Faculty of Electronics, Photonics, and Microsystems at the Wrocław University of Technology, is focused on advanced education in the field of modern electronic technologies. The program combines in-depth theoretical knowledge with the development of advanced practical skills in the design of complex electronic systems, analog and digital circuits, microwave technology, optoelectronics, and laser and fiber-optic technologies. A key element of the program is the practical application of microprocessor-based systems, programmable logic devices, and signal processors using state-of-the-art laboratory facilities. Conducting the program in English enables students to develop specialized language skills and prepares them to function in an international academic and professional environment.
Graduates of the Electronics program possess in-depth knowledge of electronics, optoelectronics, high-frequency technology, and telecommunications. They are prepared to carry out advanced engineering and research and development projects, lead project teams, and solve complex technical and scientific problems. They are able to identify, analyze, and implement innovative technical solutions, taking into account the social, environmental, and ethical aspects of engineering practice.
Graduates possess the skills necessary for professional technical communication in English, preparing project documentation and technical reports, and presenting the results of research and design work. They are prepared to work in international research and development teams and to participate in projects carried out in collaboration with foreign partners.
The qualifications obtained prepare graduates for employment in the high-tech sector, particularly in design and engineering offices,

corporate research and development departments, scientific research institutions, and academic institutions.
Graduates are also prepared to continue their education in a doctoral program, particularly in the fields of automation, electronics, electrical engineering, and space technology, as well as related disciplines. The competencies acquired form the basis for conducting independent scientific research, participating in national and international research projects, and pursuing further professional development in line with the principle of lifelong learning.

Currentness of the study programme

Concept and goals of education

The educational concept for the Electronics program is based on the close integration of theoretical knowledge with its practical application. Particular emphasis is placed on developing the ability to creatively solve complex technical and algorithmic problems and to critically evaluate solutions developed through design and research processes. The teaching priority is to ensure the highest quality, the reliability of scientific communication, and the constant relevance of the curriculum, taking into account contemporary trends and dynamic technological changes.
The goal of the program is to provide students with complementary general knowledge focused on the fields of electronics and optoelectronics, as well as specialized knowledge. The educational process is designed to develop and enhance the skills and social competencies necessary for effectively and independently performing advanced engineering and research tasks in future professional roles.
An essential element of implementing the educational concept is the use of English in the teaching process. Instruction conducted in English supports the achievement of learning outcomes related to the acquisition, analysis, and critical interpretation of specialized scientific literature and technical documentation of an international scope. It also facilitates the development of communication skills necessary for functioning in an international professional and academic environment, including participation in international project and research teams. Delivering some of the learning outcomes in English increases students' academic mobility, promotes the internationalization of the educational process, and enhances graduates' competitiveness in the domestic and international job markets.

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

Before the launch of the AAE program several representatives of companies active in electronics and similar industries had been consulted. Moreover, the syllabuses were analysed of various educational institutions, both in Poland and abroad. The curriculum makes an effort to meet the market needs for competences common for electrical engineering, automation and telecommunications. The teaching result is an expanded theoretical and practical expertise in the design of advanced electronic circuits using analogue and digital circuits, lasers, optical fibers and microwave techniques, as well as a thorough ability to use the microprocessor and programmable logic systems and signal processors. Education provided through this specialization ensures familiarity with specialist English terminology and gives the graduate the ability to combine the various aspects of analogue and digital electronics and optoelectronics. AAE graduates gain a competitive advantage in the labour market particularly in the case of multinationals dealing with digital and analogue electronics and optoelectronics in their broadest sense as well as those, in which exchange of information in English is the basis for efficient communication. By making the research labs available to students, the AAE curriculum allows them to learn about independent and team research & scientific work, thus meeting the needs of scientific and research & scientific institutions in terms of providing able and creative candidates for PhD studies or employment as research and teaching assistants.

The following elements were taken into account when creating the learning outcomes:

1. Antończak-Świder K., Biernat A., "Barometr Zawodów X edycja", 2024 - commissioned by the Minister of Family, Labor and Social Policy.
2. Łapińska J., et al., "Report on empirical research on competences and professions of the future". Warsaw: Platform of the Industry of the Future, 2022.
3. Regulation (EU) 2023/1781 of the European Parliament and of the Council of September 13, 2023, establishing a framework for measures to strengthen the European semiconductor ecosystem and amending Regulation (EU) 2021/694 - document No. 32023R1781.
4. "Strategy for Responsible Development until 2020 (with an outlook until 2030)" - adopted by resolution of the Council of Ministers on February 14, 2017.
5. Jelonek M., et al., "Analysis of the demand for competences in the economy and on the labor market, including a study of the target value of the long-term common POWER indicator in the area of higher education." 2019.
6. "Competencies of the future as the key to Poland's technological development. Opportunities and challenges for employers and

companies from the private and public sectors.” Conference organized by the Polish-German Chamber of Industry and Commerce and the Łukasiewicz Research Network - PORT Polish Center for Technology Development, Wrocław, February 6, 2024.
7. Strategy of smart specializations of Lower Silesia in the field of electronics and related fields and National Smart Specializations (KIS 4, 9, 11).

Other important factors determining the validity of the study programme

The relevance and high academic quality of the Electronics degree program are determined by two fundamental institutional pillars:
• The advanced expertise of the academic and teaching staff: The teaching process is carried out by a highly qualified team of faculty members who actively participate in national and international research, applied, and research-and-implementation projects. The direct link between research and teaching ensures that the latest advances in electronics and optoelectronics are incorporated directly into the curriculum of laboratory sessions and lectures. As a result, students have constant access to knowledge based on real, ongoing research and technological innovations.
• Synergy with industry and the business environment: The degree program is regularly evaluated and updated through close collaboration with leading companies in the high-tech sector. This cooperation involves continuous monitoring of the rapidly changing needs and expectations of the labor market, as well as the joint development of innovative technological solutions. The active involvement of industry representatives in the consultation process for the degree program and the implementation of joint, innovative research and implementation projects ensure that the educational profiles are perfectly aligned with the current and anticipated challenges of the modern economy.

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

The study program is fully correlated with the university's mission and development strategy adopted by the Senate of the Wrocław University of Science and Technology. In particular, the study program benefits from the sectoral models defined in the document's strategic objectives and initiatives, section 7 of the Development Plan of the Wrocław University of Science and Technology: the Education Model and the Study Model, in order to ensure high-quality teaching. Students of the program follow the study model defined in the development strategy of the Faculty of Electronics, Photonics and Microsystems. The educational concept of the Faculty takes into account the perspective of the development of higher education in the years 2015-2030 defined by the Ministry of Science and Higher Education.

By providing general academic studies, the Faculty addresses its offer to people interested in development and improving their qualifications. Ultimately, studies of this profile should prepare professional staff for the economy and science. Education in the field of electronics is concurrent with the strategic framework for smart specializations of Lower Silesia in the field of electronics and related areas, as well as the National Smart Specializations in the field of smart technologies and industrial processes.

In the case of the AAE specialization, conducting the teaching process in English is a key factor driving the dynamic internationalization of the program. This approach opens up extensive opportunities for intensive academic exchange, involving both students and faculty, through prestigious international programs such as Erasmus and Erasmus+, bilateral university agreements, and European and global cooperation networks.

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_EKA_W01	Defines and explains advanced concepts in selected branches of mathematics necessary for analyzing complex problems in the field of electronics.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W02	Identifies and explains concepts in selected branches of modern physics, necessary for understanding advanced physical phenomena within the studied scientific discipline.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W03	Describes the process of creation and development of forms of individual entrepreneurship in the area relevant to the field of study, including aspects of industrial property protection and copyright law.	P7U_W, P7S_WK	P7S_WK_INŻ
K2_EKA_W04	Explains the structure and operating principles of lasers, lists their basic properties and parameters, and describes the mechanisms of light propagation in optical fibers.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W05	Lists and describes the principles of optimization algorithms used to solve problems in electronics.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W06	Lists and describes advanced numerical methods and algorithms, as well as their implementation techniques for efficient solution of problems occurring in electronics.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W07	Recognizes and characterizes contemporary achievements and main development directions of technologies used in electronics.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W08	Describes the structure, operating principles, and applications of advanced systems and technologies used in modern electronic and telecommunications equipment, as well as in control and measurement systems.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W09	Lists and characterizes methods of acquisition, transmission, and processing of measurement data in selected areas of technology.	P7U_W, P7S_WG	P7S_WG_INŻ
K2_EKA_W10	Distinguishes and describes the architectures of microprocessor and programmable systems, their applications in selected fields of science and technology, and characterizes the methods and tools necessary for their effective implementation and testing.	P7U_W, P7S_WG	P7S_WG_INŻ
Skills			
K2_EKA_U01	Prepares a master's thesis containing research aspects, including: - gathers information from literature, databases, and other sources, integrates, interprets, and critically evaluates it, - plans and conducts experiments, including measurements and computer simulations, interprets the obtained results, and draws conclusions, - uses analytical, simulation, and experimental methods to formulate and solve problems, - formulates and tests hypotheses related to research problems, - integrates knowledge from various fields and disciplines and applies a systemic approach, also considering non-technical aspects, - assesses the applicability and potential use of new achievements (techniques and technologies) in the represented discipline, - proposes improvements or optimizations to existing technical solutions, - interprets the obtained research results, draws appropriate conclusions, and formulates recommendations, - prepares the master's thesis in accordance with formal requirements.	P7U_U, P7S_UW, P7S_UK, P7S_UU	P7S_UW_INŻ

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_EKA_U02	Classifies and evaluates various solutions emerging from the design or research process and estimates the economic feasibility and time requirements of planned data acquisition, processing, and analysis activities.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_EKA_U03	Searches for specialized texts and assesses the potential applications of new achievements in the techniques and technologies used in electronics; based on literature sources and the results of his own work, he integrates, interprets, and critically evaluates the presented content in his own presentation.	P7U_U, P7S_UK	
K2_EKA_U04	Applies advanced mathematical methods to describe, analyze, and solve complex problems in the field of electronics.	P7U_U, P7S_UW	
K2_EKA_U05	Applies optimization algorithms to solve problems in electronics.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_EKA_U06	Applies selected numerical algorithms to solve complex problems in electronics and develops and analyzes numerical models of systems and dynamic objects.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_EKA_U07	Selects tools and resources and proposes technical and algorithmic solutions that enable the effective design and put into operation of a complex electronic system using available signal conditioning, processing and acquisition techniques.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_EKA_U08	Plans and conducts complex numerical and empirical experiments, interprets the obtained results, and draws conclusions regarding their application in selected fields.	P7U_U, P7S_UW	P7S_UW_INŻ
K2_EKA_U09	Reports on the individual phases of a complex project (e.g., a diploma thesis), prepares presentations containing the results of conducted experiments, and derives and justifies the resulting conclusions. Applies the principles of creative discussion and assumes the role of a moderator within the group.	P7U_U, P7S_UW, P7S_UK, P7S_UO, P7S_UU	P7S_UW_INŻ
K2_EKA_U10	Plans and implements the process of self-education, identifies possible directions for further development of knowledge, skills, and competencies, and provides guidance to others in this regard.	P7U_U, P7S_UU	
K2_EKA_U11	Collaborates in the execution of complex tasks and projects, responsibly fulfilling assigned roles within the team and adhering to professional ethics.	P7U_U, P7S_UO	
Social competence			
K2_EKA_K01	Demonstrates initiative in communicating information and opinions to the public regarding current developments in science and technology and other aspects of the technical university. Appreciates the role of the mass media and is ready to create models of appropriate behavior in the social and professional environment in relation to the field of electronics. Respects the principles of social interaction and the social consequences of engineering activities and the related responsibility for decisions.	P7U_K, P7S_KO, P7S_KR	
K2_EKA_K02	Is oriented towards creative and entrepreneurial action, appropriately determines priorities for the implementation of complex tasks and initiatives of an innovative nature in the conditions of sustainable development and contemporary changes and dilemmas of civilization.	P7U_K, P7S_KK, P7S_KO	
K2_EKA_K03	Cares about the positive impact of technical activities on the socio-economic environment and understands the related social responsibility of science and technology.	P7U_K, P7S_KK, P7S_KO, P7S_KR	

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_EKA_K04	Is capable of critically evaluating his own knowledge and received information; shows initiative in improving competence in both engineering and interdisciplinary sciences.	P7U_K, P7S_KK, P7S_KR	
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

elektronika w języku angielskim

Name	Advanced Applied Electronics
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)	83/90 (92.22%)
Number of ECTS points allocated to classes developing practical skills (including laboratory, project) (P)	52.8
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)	45.6
Percentage of ECTS for elective courses	31/90 (34.44%)
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)	10

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

Foreign languages should be completed by the end of the second semester at the latest.

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 diploma thesis; diploma examination
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

Following the curriculum, students attend organized classes. According to the regulations of higher education at Wrocław University of Science and Technology, the student is required to participate in classes. Classes are conducted in the forms specified in the regulations of studies, with the use of both traditional methods and didactic tools as well as the possibilities offered by the university e-learning platform. Outside of class hours, the tutors are available to students during the consultation hours designated and announced on the Faculty's website. An important element of the learning process is the student's own work, consisting in preparing for classes (on the basis of materials provided by the lecturers and recommended literature), studying literature, preparing reports and reports, preparing for tests and exams.

Each learning outcome is assigned the codes of the subjects defined in the study program. Successful completion of these subjects (this subject) means obtaining the given effect. Subjects are credited on the basis of the forms of control of acquired knowledge, skills and social competences, defined in the subject cards. Failure to achieve the learning outcomes assigned to the subject by the student results in the failure to complete the subject and the necessity to do it again. Completion of each semester of studies is conditional upon obtaining the number of ECTS points in a specific study program, which is tantamount to achieving most of the learning outcomes envisaged in a given semester. The remaining results are achieved by the student re-completing the failed subjects in subsequent semesters of study.

Successful completion of studies is possible after the student achieves all learning outcomes specified in the study program. The quality of the classes and the achievement of learning outcomes are controlled by the Department's Education Quality Assurance System, including, inter alia, procedures for creating and modifying education programs, individualizing study programs, implementing the

teaching process and diplomas. Quality control of the education process includes the evaluation of the learning outcomes achieved by students. Quality control of the classes is supported by hospitals and surveys, carried out according to strictly defined departmental procedures.

Internships

Diploma exam

Carried out in accordance with the Study Regulations in force at the Wrocław University of Science and Technology. The scope of the diploma exam covers the educational content provided as part of the studies, and the list of compulsory diploma topics is updated in consultation with the academic teachers conducting individual classes, approved by the Programme Committee and published on the Faculty's website, by the date indicated in the Study Regulations.

Study plan

elektronika w języku angielskim

Semester 1

The student completes basic and specialized subjects necessary to understand the phenomena, problems and challenges in the field of electronics and optoelectronics. The student also completes compulsory language and humanities/management classes.

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Partial Differential Equations with Applications in Physics and Industry	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 3	Obligatory
Numerical Methods and Optimization	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Obligatory
Optical Fibres and Optocommunication	Lecture: 30 Laboratory: 15 Seminar: 15	Lecture: Exam Laboratory: Graded credit Seminar: Graded credit	Lecture: 2 Laboratory: 2 Seminar: 1	Obligatory
New Approaches in Electronics and Photonics	Lecture: 30	Graded credit	2	Obligatory
Microcontroller Programming	Lecture: 30 Laboratory: 30 Project: 30	Lecture: Exam Laboratory: Graded credit Project: Graded credit	Lecture: 2 Laboratory: 2 Project: 2	Obligatory
Foreign Language 2.1	Classes: 30	Graded credit	2	Obligatory group
Student/ka wybiera jeden przedmiot językowy z oferty ogólnouczelnianej				
Foreign Language 2.1	Classes: 30	Graded credit	2	Elective
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
Social Communication	Seminar: 15	Graded credit	2	Obligatory elective
Sum	**405**		**29**	

Semester 2

Advanced Applied Electronics

The student completes a block of specialized subjects in the field of electronics and optoelectronics. The student decides on the topic of the master thesis by participating in a specialized seminar.

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Lasers and Applications	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Obligatory
DSP Architectures	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 2 Laboratory: 3	Obligatory
Hardware Programming	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 2 Laboratory: 3	Obligatory
Analog Peripherals of Digital Systems	Lecture: 30 Laboratory: 30 Project: 15	Lecture: Graded credit Laboratory: Graded credit Project: Graded credit	Lecture: 2 Laboratory: 2 Project: 1	Obligatory
RF Circuits Design	Lecture: 15 Laboratory: 30 Project: 15	Lecture: Graded credit Laboratory: Graded credit Project: Graded credit	Lecture: 1 Laboratory: 2 Project: 1	Obligatory
Machine Learning Methods	Lecture: 15 Laboratory: 15 Seminar: 15	Lecture: Graded credit Laboratory: Graded credit Seminar: Graded credit	Lecture: 1 Laboratory: 1 Seminar: 1	Obligatory
Specialization Seminar	Seminar: 45	Graded credit	2	Obligatory
Sum	**405**		**28**	

Semester 3

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Entrepreneurship	Lecture: 15 Seminar: 15	Lecture: Graded credit Seminar: Graded credit	Lecture: 2 Seminar: 1	Obligatory elective
Sum	**30**		**3**	

Advanced Applied Electronics

The student continues specialized classes and conducts research related to the completion of the master's thesis. By studying entrepreneurship, the student learns practical issues related to the economic basis of business activity. The studies end with a diploma exam.

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Master Thesis	Diploma thesis: 60	Graded credit	15	Obligatory elective
LabVIEW Programming	Lecture: 15 Project: 30	Lecture: Graded credit Project: Graded credit	Lecture: 1 Project: 3	Obligatory
Diploma Seminar	Seminar: 30	Graded credit	2	Obligatory
Computer Operating Systems	Lecture: 15 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 1 Laboratory: 2	Obligatory
Elective Subjects	Lecture: 45 Total practical contact hours: 45	Graded credit	6	Obligatory group
The student chooses and completes subjects for at least 6 ECTS				
Real Time Operating Systems	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Elective
Advanced Object Oriented Programming	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Elective
Optics and Nonlinear Optics	Lecture: 15 Classes: 15	Lecture: Graded credit Classes: Graded credit	Lecture: 1 Classes: 1	Elective
IoT Modules	Lecture: 15 Project: 15	Lecture: Graded credit Project: Graded credit	Lecture: 1 Project: 1	Elective
Sum	**270**		**30**	

Syllabuses

Wrocław University of Science and Technology

Partial Differential Equations with Applications in Physics and Industry

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality -	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Subjects of basic education - mathematics
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 1	• Lecture: 30 h, 2 ECTS, Graded credit • Laboratory: 30 h, 3 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Quotes the most important theorems from the main sections of differential equations.	K2_EKA_W01
PEU_W02	Explains the rules of modeling using differential equations in technical or natural sciences, especially physics, chemistry, and biology.	K2_EKA_W01
In terms of skills		
PEU_U01	Analyzes issues in differential equations.	K2_EKA_U04
PEU_U02	Constructs mathematical models using differential equations, used in specific applications of mathematics.	K2_EKA_U04

Program content ensuring learning outcomes

The subject focuses on the application of partial differential equations to modeling and solving real-world problems, such as heat flows, conservation laws, potential determination, and vibration description. The subject covers basic types of partial equations (elliptic, parabolic, and hyperbolic) and methods for solving them, both analytical and numerical. Students learn to apply their knowledge in practice, using computational tools to simulate and analyze physical phenomena in technology.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Preparaton for classes	16
Preparation of a project	16
Preparation for an exam/credit	15
Self-study of class topics	18
Student workload	**Hours** 125

Wrocław University of Science and Technology

Numerical Methods and Optimization

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality -	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Major-specific subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 1	• Lecture: 30 h, 2 ECTS, Graded credit • Laboratory: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Explains the basic algorithms for matrix factorization, methods for determining eigenvalues and eigenvectors, methods for solving linear least-squares problems, methods for solving underdetermined systems, and basic iterative methods.	K2_EKA_W05
PEU_W02	Formulates numerical optimization problems and identifies appropriate methods for solving linear programming problems, nonlinear optimization problems with and without constraints, nonlinear equations, and heuristic optimization problems.	K2_EKA_W05
In terms of skills		
PEU_U01	Develops an implementation of a given numerical algorithm and tests it in a computational environment	K2_EKA_U04, K2_EKA_U05
PEU_U02	Examines the properties of a given optimization problem and selects an algorithm to solve it	K2_EKA_U04, K2_EKA_U05

Program content ensuring learning outcomes

In-depth knowledge in the area of numerical methods and optimization, in particular methods for solving various systems of linear equations, matrix factorizations, eigenvalues and eigenvectors computation, least squares problems, linear regression, regularization, underdetermined problems, iterative methods, linear programming, unconstrained and constrained optimization, nonlinear equations and selected issues in metaheuristics.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Preparation of a report/summary/presentation/paper	20
Preparaton for classes	10
Preparation for an exam/credit	5
Self-study of class topics	5
Student workload	**Hours** 100

Wrocław University of Science and Technology

Optical Fibres and Optocommunication

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality -	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Subjects of basic education - physics
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 1	• Lecture: 30 h, 2 ECTS, Exam • Laboratory: 15 h, 2 ECTS, Graded credit • Seminar: 15 h, 1 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Explains the different methods of optical telecommunications and their parameters.	K2_EKA_W02
PEU_W02	Explains descriptions of the physics of light propagation in optical fibres. Explains optical fibre manufacturing technologies, defines the basic types and parameters of optical fibres.	K2_EKA_W04
In terms of skills		
PEU_U01	Plans and performs basic experimental work in the field of fiber optics. Sets up fiber-optic equipment, such as amplifiers, fiber lasers, and systems for modulating and detecting light. Uses optical and fiber-optic components in representative experiments.	K2_EKA_U06

Program content ensuring learning outcomes

An in-depth analysis of the physical phenomena involved in fiber-optic technology and their significance for the design and operation of modern optical systems.
Analysis of the mechanisms of light propagation in optical fibers and evaluation of the impact of material and design parameters on the transmission properties of optical fibers.
Characterization and evaluation of optical fiber manufacturing technologies, and a comparison of the properties and applications of various types of optical fibers used in optical communication systems.
Analysis of the architecture, operating principles, and performance parameters of modern fiber-optic telecommunications systems, taking into account current trends in technological development.
Planning and conducting experiments in the field of fiber-optic optics, compiling and interpreting measurement results, and drawing conclusions regarding the properties of the tested components and systems.
Searching for, critically analyzing, and synthesizing information contained in English-language scientific publications and conference materials in the field of optical communications (e.g., ECOC—European Conference on Optical Communications), in order to acquire up-to-date knowledge and identify trends in the development of fiber-optic technologies.
Uses optical and fiber-optic components in representative experiments.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	15
Seminar	15
Preparaton for classes	18
Preparation of a report/summary/presentation/paper	14
Credit/Exam	4
Preparation for an exam/credit	14
Self-study of class topics	15
Student workload	**Hours** 125

Wrocław University of Science and Technology

New Approaches in Electronics and Photonics

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality -	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Major-specific subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 1	• Lecture: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Discusses and identifies development trends and the most significant new achievements in the area of the studied scientific discipline.	K2_EKA_W07
PEU_W02	Discusses and identifies development trends and the most significant new achievements in the area of the advanced electronic and photonic systems.	K2_EKA_W07
In terms of social competences		
PEU_K01	Identifies current trends and issues in the development of the field of electronics and photonics, explains, and discusses scientific and technical solutions	K2_EKA_K02

Program content ensuring learning outcomes

In-depth knowledge of development trends and the most significant new developments in the area of the scientific discipline studied, including advanced electronics and photonics, in the following areas: femtosecond lasers; laser and terahertz spectroscopy; fiber optic photonic systems; laser micromachining; advanced electronics and its applications in laser, automotive, medicine, and other fields.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Preparation for an exam/credit	10
Self-study of class topics	10
Student workload	**Hours** 50

Wrocław University of Science and Technology

Microcontroller Programming

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim **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** 2026/2027 **Lecture languages** English **Mandatoriness** Obligatory **Block** Specialty subjects **Subject related to scientific research** Yes

Semester	**Activities, hours, ECTS and examination**
Semester 1	• Lecture: 30 h, 2 ECTS, Exam • Laboratory: 30 h, 2 ECTS, Graded credit • Project: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Categorizes modern microcontrollers.	K2_EKA_W10
PEU_W02	Identifies application areas of microcontrollers.	K2_EKA_W10
PEU_W03	Lists methods and tools used to program microcontrollers.	K2_EKA_W10
PEU_W04	Selects the right layout depending on the application.	K2_EKA_W10
In terms of skills		
PEU_U01	Uses the development environment in the right way.	K2_EKA_U07
PEU_U02	Utilizes the microcontroller's internal resources in the implementation of complex projects.	K2_EKA_U07, K2_EKA_U11

PEU_U03	Designs a circuit board working with a microcontroller.	K2_EKA_U07, K2_EKA_U11

Program content ensuring learning outcomes

Analysis of the architectures of modern microcontrollers and 8-, 16-, and 32-bit systems.
Characterization and comparison of basic and advanced microcontroller families.
Assessment of the potential applications of microcontrollers in embedded, control, and measurement systems.
Analysis of microcontroller programming methods and the utilization of their hardware resources and communication interfaces.
Design and implementation of microcontroller software in selected engineering applications.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Project	30
Preparaton for classes	9
Preparation of a report/summary/presentation/paper	10
Preparation for an exam/credit	3
Credit/Exam	4
Self-development of practical skills	14
Preparation of a project	15
Self-study of class topics	5
Student workload	**Hours** 150

Wrocław University of Science and Technology

Foreign Language 2.1

Educational subject description sheet

Basic information

Field of study lektoraty	**Education cycle** 2026/2027
Speciality -	**Lecture languages** English
Organizational unit Wrocław University of Science and Technology	**Mandatoriness** Elective
Study level second degree	**Block** Foreign languages
Study form full-time studies	
Education profile general academic profile	

Semesters	**Activities, hours, ECTS and examination**
Semester 1, Semester 2, Semester 3	• Classes: 30 h, 2 ECTS, Graded credit

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, GermanC1 plus English languageGeneral 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

Wrocław University of Science and Technology

Foreign Language 2.2

Educational subject description sheet

Basic information

Field of study lektoraty **Speciality** - **Organizational unit** Wrocław University of Science and Technology **Study level** second degree **Study form** full-time studies **Education profile** general academic profile	**Education cycle** 2026/2027 **Lecture languages** English **Mandatoriness** Elective **Block** Foreign languages

Semesters	**Activities, hours, ECTS and examination**
Semester 1, Semester 2, Semester 3	• Classes: 60 h, 3 ECTS, Graded credit

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

Wrocław University of Science and Technology

Social Communication

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality -	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory elective
Study level second degree 3 semesters	**Block** Subjects from the fields of humanities or social sciences
Study form full-time studies	
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 1	• Seminar: 15 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of social competences		
PEU_K01	A student is able to apply the knowledge that they have learned to formulate and solve complex and non-routine problems as well as innovatively carry out tasks under unpredictable conditions by: • properly selecting sources and information from them; conducting an assessment, critical analysis, synthesis and creative interpretation and presentation of this information, • selecting and using proper methods and tools, including advanced techniques of information communications technology (ICT), • adapting existing or developing new methods and tools.	K2_EKA_K01
PEU_K02	Is ready to think and act in an enterprising manner.	K2_EKA_K03

Program content ensuring learning outcomes

The aim of the course is for students to acquire knowledge and skills that will allow them to shape competences related to social communication in various forms. The course will also develop basic skills in effective public speaking, writing, and

using IT tools, which aims to prepare students to act effectively in a changing world and influence it. Thanks to the knowledge they have gained about language, communication barriers, the use of technology for communication, and practical experience, participants will be better prepared to take on challenges related to changes in the modern world, as well as establishing interpersonal relationships and understanding the broad context of intercultural and intercivilizational relations.

Calculation of ECTS points

Activity form	**Activity hours**
Seminar	15
Preparation of a report/summary/presentation/paper	15
Preparation for an exam/credit	10
Conducting literature research	10
Student workload	**Hours** 50

Wrocław University of Science and Technology

Lasers and Applications

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 2	• Lecture: 30 h, 2 ECTS, Graded credit • Laboratory: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Can describe the physical phenomena behind the generation of coherent electromagnetic radiation.	K2_EKA_W04
PEU_W02	Classifies types of lasers, lists their parameters and describes their applications.	K2_EKA_W04
In terms of skills		
PEU_U01	Can carry out an elementary experiment in laser and fiber optics technology, related to the use of typical optical elements and diagnostic and measurement equipment	K2_EKA_U08

Program content ensuring learning outcomes

In-depth knowledge of the advanced physics of lasers and the mechanisms occurring in lasers, the main parameters of

lasers, distinguishing different types of lasers, and their most important applications. Expand skills in conducting experiments in the field of laser technology, using measurement apparatuses, measuring the parameters of lasers, and interpreting and analyzing the obtained measurement results independently.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Preparation for an exam/credit	5
Preparation of a report/summary/presentation/paper	23
Self-study of class topics	12
Student workload	**Hours** 100

Wrocław University of Science and Technology

DSP Architectures

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 2	• Lecture: 30 h, 2 ECTS, Exam • Laboratory: 30 h, 3 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Describes the architectures of DSP processing structures, particularly signal microcontrollers.	K2_EKA_W10
PEU_W02	Describes operations of DSP processing structures, particularly signal microcontrollers.	K2_EKA_W10
In terms of skills		
PEU_U01	Uses development tools—from the installation stage through configuration and preparation for program execution.	K2_EKA_U07
PEU_U02	Proposes technical and algorithmic solutions that enable the efficient design and implementation of a complex electronic system using available signal conditioning, processing, and acquisition techniques.	K2_EKA_U07

Program content ensuring learning outcomes

The scope of the subject includes equipping students with knowledge of DSP processor architecture, efficient methods of generating program code along with debugging tools, signal representation, issues related to sampling and quantization, digital signal processing theory, and the design and implementation of digital filters. Students will gain practical skills in signal analysis and in developing signal processing algorithm programs, taking into account the specifics of programming languages (ASM, C, Python) and the hardware characteristics of DSP processors. The overall content aims to provide comprehensive theoretical knowledge and practical skills applicable in real-world signal processing projects using DSP processors.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Preparaton for classes	15
Preparation of a report/summary/presentation/paper	30
Preparation for an exam/credit	6
Self-study of class topics	10
Credit/Exam	4
Student workload	**Hours** 125

Wrocław University of Science and Technology

Hardware Programming

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 2	• Lecture: 30 h, 2 ECTS, Exam • Laboratory: 30 h, 3 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Describes various programmable logic structures.	K2_EKA_W10
PEU_W02	Enumerates the components present in FPGAs and ASICs.	K2_EKA_W10
PEU_W03	Characterizes hardware description languages.	K2_EKA_W10
In terms of skills		
PEU_U01	Develops software for devices containing programmable logic circuits.	K2_EKA_U05, K2_EKA_U06, K2_EKA_U11
PEU_U02	Uses the functional blocks of FPGAs and ASICs.	K2_EKA_U05, K2_EKA_U06
PEU_U03	Adapts the algorithm to the design requirements.	K2_EKA_U05, K2_EKA_U11

Program content ensuring learning outcomes

The subject includes deepening the knowledge of modern programmable device structures; the main structures, parameters and applications of such circuits; programming in VHDL.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Preparaton for classes	10
Preparation of a report/summary/presentation/paper	10
Preparation for an exam/credit	10
Credit/Exam	4
Self-study of class topics	20
Self-development of practical skills	11
Student workload	**Hours** 125

Wrocław University of Science and Technology

Analog Peripherals of Digital Systems

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 2	• Lecture: 30 h, 2 ECTS, Graded credit • Laboratory: 30 h, 2 ECTS, Graded credit • Project: 15 h, 1 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Characterizes the basic requirements for analog circuits in digital systems as well as the configuration of an electronic circuit for a given application area and the required parameters.	K2_EKA_W09
PEU_W02	Defines the sources of noise in electronic circuits, explains how to reduce them and their impact on signal integrity.	K2_EKA_W09
In terms of skills		
PEU_U01	Carries out a laboratory experiment using advanced measuring equipment for complex electronic systems.	K2_EKA_U08
PEU_U02	Selects the configuration of an analog system cooperating with a digital system, taking into account the problems of emission of electromagnetic noise and immunity to external disturbances.	K2_EKA_U07

Program content ensuring learning outcomes

In-depth knowledge of electronic components and analog circuits used as peripheral circuits in digital electronic systems.
In-depth knowledge of sources of intrinsic noise and interference in electronic circuits, methods for reducing them, and their impact on signal integrity.
Skills in designing analog circuits and conducting laboratory experiments using advanced measuring equipment.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Project	15
Preparation of a report/summary/presentation/paper	20
Preparation of a project	20
Preparation for an exam/credit	10
Student workload	**Hours** 125

Wrocław University of Science and Technology

RF Circuits Design

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 2	• Lecture: 15 h, 1 ECTS, Graded credit • Laboratory: 30 h, 2 ECTS, Graded credit • Project: 15 h, 1 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Explain application of microwave technology applications in electronics, telecommunications, industry, medicine, navigation, transportation.	K2_EKA_W08
PEU_W02	Explain application of the typical circuit and field parameters describing high frequecy circuits and systems.	K2_EKA_W08
PEU_W03	Explain application of the construction and parameters of passive and active high frequency circuits and systems manufactured in: microstrip, stripline, LTCC and MMIC technology.	K2_EKA_W08
PEU_W04	Selects design methods and uses advanced CAE tools for modeling, analysis, verification, and optimization of high-frequency circuits implemented using microstrip technology.	K2_EKA_W08

PEU_W05	Analyzes the properties, limitations, and scope of application of the equipment, methods, and measurement techniques used in high-frequency engineering.	K2_EKA_W08
In terms of skills		
PEU_U01	Using CAE software for high frequency circuit analysis and design.	K2_EKA_U07
PEU_U02	Using of basic concepts and fundamental field and circuits parameters describing transmission lines and high frequency circuits and systems.	K2_EKA_U08
PEU_U03	Has the ability to prepare and perform measurements utilizing methods and equipment used in high frequency technique	K2_EKA_U08

Program content ensuring learning outcomes

An analysis of the applications of microwave technology in modern electronic, telecommunications, industrial, medical, navigation, and transportation systems, as well as in research equipment used in solid-state physics and astronomy.
Characterization of circuit parameters and electromagnetic fields used to describe microwave systems, in particular the voltage standing wave ratio (VSWR), reflection coefficient, reflection attenuation, and scattering matrix, as well as issues related to impedance matching and power transmission in high-frequency circuits.
Analysis of the structure, properties, and parameters of passive and active microwave circuits implemented using microstrip, LTCC, and MMIC technologies.
Evaluation of the impact of the manufacturing technology used on the functional parameters, reliability, and application areas of high-frequency circuits.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	15
Laboratory	30
Project	15
Preparation of a project	10
Preparation of a report/summary/presentation/paper	10
Self-study of class topics	10
Preparation for an exam/credit	5
Preparaton for classes	5
Student workload	**Hours** 100

Wrocław University of Science and Technology

Machine Learning Methods

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 2	• Lecture: 15 h, 1 ECTS, Graded credit • Laboratory: 15 h, 1 ECTS, Graded credit • Seminar: 15 h, 1 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Presents basic methods of unsupervised learning	K2_EKA_W09
PEU_W02	Describes basic methods of supervised learning	K2_EKA_W09
PEU_W03	Selects appropriate machine learning methods to solve selected tasks in measurement data analysis and processing, image processing, pattern recognition, and spectral analysis.	K2_EKA_W06, K2_EKA_W09
In terms of skills		
PEU_U01	Constructs a machine learning task, tests its properties and selects the appropriate algorithm to solve it	K2_EKA_U06
PEU_U02	Implements and tests machine learning algorithms in a given computing environment	K2_EKA_U06

Program content ensuring learning outcomes

In-depth knowledge and skills in the field of machine learning methods, in particular learning systems, selected neural network architectures, statistical classification, pattern recognition, clustering, dimensionality reduction, and tensor decomposition models.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	15
Laboratory	15
Seminar	15
Preparaton for classes	5
Preparation for an exam/credit	5
Preparation of a report/summary/presentation/paper	20
Student workload	**Hours** 75

Wrocław University of Science and Technology

Specialization Seminar

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 2	• Seminar: 45 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Prepares an advanced presentation on a selected topic in English. The series of presentations made by the student ends with finding a promoter and defining the topic of the student's thesis.	K2_EKA_U03, K2_EKA_U09
In terms of social competences		
PEU_K01	Is oriented to creative and entrepreneurial action, appropriately determines priorities for the implementation of complex tasks and projects of innovative nature in the conditions of sustainable development and contemporary changes and dilemmas of civilization.	K2_EKA_K02
PEU_K02	Is able to critically evaluate his/her own knowledge and received content, and shows initiative in improving competence both in engineering and technical sciences and in the interdisciplinary dimension.	K2_EKA_K04

Program content ensuring learning outcomes

There are three purposes of this seminar:
1. By preparing any topic related to the field of studies, the student reveals his professional interests and this is a prelude to the search for a thesis topic. This can be, for example, the refereeing of his engineering thesis.
2. The second goal of this seminar is to prepare a presentation in English, typical of conference speeches, where, with, for example, 20 minutes at your disposal, you have to rearrange the essence of the presentation and answer questions from the audience.
3. The third and most important goal of this seminar is for the student to find a thesis supervisor and determine the topic of the thesis, so that before the summer vacation the student can already start working on his/her MSc project.
Everyone should give 3 presentations per semester. Since most students will not yet have defined master's topics at the beginning, the first presentation should be related to engineering work or to some topic of interest to him/her. The first 5 terms will be devoted to this.

In the meantime a few scientists looking for master's students will be invited to present their expectations and potential topics for master's theses. Then, after the first 5 terms, the second round of elementary presentations related to potential MSc theses will start. And after 10 meetings the third round of these MSc presentations, more advanced, will be realized.

At the first seminar, the scopes of your interests and the plan of presentations for the upcoming dates will be established. Each presentation should be sent to the academic teacher providing the seminar.

Calculation of ECTS points

Activity form	**Activity hours**
Seminar	45
Preparation of a report/summary/presentation/paper	5
Student workload	**Hours** 50

Wrocław University of Science and Technology

Entrepreneurship

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality -	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory elective
Study level second degree 3 semesters	**Block** Subjects from the fields of humanities or social sciences
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 3	• Lecture: 15 h, 2 ECTS, Graded credit • Seminar: 15 h, 1 ECTS, Graded credit

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_EKA_W03
In terms of social competences		
PEU_K01	Solves problems in an innovative and entrepreneurial way and is capable of creating and developing innovative companies	K2_EKA_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
Preparaton for classes	15
Preparation of a report/summary/presentation/paper	15
Conducting literature research	15
Student workload	**Hours** 75

Wrocław University of Science and Technology

Master Thesis

Educational subject description sheet

Basic information

Field of study
elektronika w języku angielskim

Speciality
Advanced Applied Electronics

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
2026/2027

Lecture languages
English

Mandatoriness
Obligatory elective

Block
Specialty subjects

Subject related to scientific research
Yes

Semester	Activities, hours, ECTS and examination
Semester 3	• Diploma thesis: 60 h, 15 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Searches effectively for information in the world literature using publication databases, technical documentation, etc. Integrates and interprets the literature materials found.	K2_EKA_U01, K2_EKA_U02
PEU_U02	Plans and experiments (laboratory or computerized). Formulates and solves problems using analytical, simulation, and experimental methods. Can interpret the obtained results of the experiment.	K2_EKA_U01, K2_EKA_U02
PEU_U03	Write a diploma thesis in the form of a dissertation, including a review of the literature, documentation of the research conducted, summary of the results, and conclusions.	K2_EKA_U01
In terms of social competences		
PEU_K01	He/she presents the results of his/her own research work. He/she defends his/her position during discussions of the obtained results, supported by appropriate arguments.	K2_EKA_K02

Program content ensuring learning outcomes

The scope of the subject is the completion of a thesis by the student, based on the knowledge acquired during the studies. As part of the subject, the student prepares under the substantive supervision of the supervisor. This thesis is of an engineering and scientific nature and requires research, calculations, experiments, etc. As part of the subject, the student writes a thesis, including his/her own original results and literature review. The Diploma Thesis subject organizes and consolidates the skills acquired during the studies and, above all, prepares students to work independently on their own projects, including in the context of conducting scientific research work.

Calculation of ECTS points

Activity form	**Activity hours**
Diploma thesis	60
Conducting literature research	40
Conducting empirical studies	150
Preparation of the thesis	110
Praca z opiekunem nad częścią merytoryczną pracy	15
Student workload	**Hours** 375

Wrocław University of Science and Technology

LabVIEW Programming

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 3	• Lecture: 15 h, 1 ECTS, Graded credit • Project: 30 h, 3 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Descibes of good practices applied in LabVIEW environment, describes data structures and methods of communication with external devices and identify the basic project templates for data acquisition	K2_EKA_W08
In terms of skills		
PEU_U01	Is be able to: use the libraries of the LabVIEW environment to create applications for the acquisition, processing and presentation of measurement data, use tools for finding errors and tracking data flow in the program, create subroutines, prepare documentation of developed programs and prepare their installation versions	K2_EKA_U06

Program content ensuring learning outcomes

The program content includes knowledge of developing programs using the graphical programming language. As a result of the subject, students will acquire the skills of: creating software useful in data acquisition, processing and presentation applications, designing interactive and intuitive user interfaces, documenting and creating programs in the installation version, and multithreaded programming in the LabVIEW environment.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	15
Project	30
Preparaton for classes	15
Preparation of a project	20
Preparation of a report/summary/presentation/paper	10
Self-study of class topics	10
Student workload	**Hours** 100

Wrocław University of Science and Technology

Diploma Seminar

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	Activities, hours, ECTS and examination
Semester 3	• Seminar: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of skills		
PEU_U01	Discusses original ideas and solutions, critically evaluates scientific and technical approaches, and prepares and presents the results of the solutions implemented to address a specific problem.	K2_EKA_U09, K2_EKA_U10
In terms of social competences		
PEU_K01	Formulates and presents his/her own stance on a specific topic.	K2_EKA_K02, K2_EKA_K04
PEU_K02	He/she is capable of conducting a discussion based on objective arguments. He/she defends his/her viewpoints and is aware of the ethical and legal aspects of research activity.	K2_EKA_K04

Program content ensuring learning outcomes

The subject covers:

- seeking out selective knowledge essential for creating original solutions,
- preparing presentations that effectively communicate one's original ideas, concepts, and solutions to the audience,
- developing the ability to engage in creative discussions, where one can substantively and factually justify and defend one's position,
- learning how to write a work showcasing personal achievements, utilizing appropriate supportive tools, including presentations of one's accomplishments within the context of the relevant literature,
- fostering creativity, independence, and the ability to effectively prioritize tasks,
- shaping awareness regarding the importance of disseminating scientific and technological achievements.

Calculation of ECTS points

Activity form	**Activity hours**
Seminar	30
Preparaton for classes	5
Preparation of a report/summary/presentation/paper	10
Conducting literature research	5
Student workload	**Hours** 50

Wrocław University of Science and Technology

Computer Operating Systems

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Obligatory
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 3	• Lecture: 15 h, 1 ECTS, Graded credit • Laboratory: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Describes the operation of modern operating systems - process management, inter-process communication mechanisms, synchronization problems and methods	K2_EKA_W08
In terms of skills		
PEU_U01	Creates multi-threaded and multi-process concurrent programs using communication and synchronization mechanisms	K2_EKA_U07

Program content ensuring learning outcomes

Advanced knowledge of the operation of modern operating systems - the process management, inter-process communication mechanisms, synchronization problems and methods. As a result of the subject, students will gain skills in creating multithreaded and multiprocess concurrent programs using communication and synchronization mechanisms.

Calculation of ECTS points

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

Wrocław University of Science and Technology

Real Time Operating Systems

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Elective
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 3	• Lecture: 30 h, 2 ECTS, Graded credit • Laboratory: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Elaborates on the general design of real-time operating systems.	K2_EKA_W10
PEU_W02	Elaborates functions of real-time operating systems.	K2_EKA_W10
In terms of skills		
PEU_U01	Creates real time applications for given real time operating systems	K2_EKA_U06

Program content ensuring learning outcomes

Program content includes knowledge about the structure and functionalities of real-time operating systems. Ase a result of subject realization students will get the practical ability to use a real-time functionalities in RTOS and to program and deploy applications in selected RTOS.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Preparaton for classes	10
Self-study of class topics	10
Preparation of a report/summary/presentation/paper	20
Student workload	**Hours** 100

Wrocław University of Science and Technology

Advanced Object Oriented Programming

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Elective
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 3	• Lecture: 30 h, 2 ECTS, Graded credit • Laboratory: 30 h, 2 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Mentions the principles of object-oriented programming.	K2_EKA_W10
PEU_W02	Indicates the ideas of object-oriented programming methodology based on Unified Modeling Language (UML).	K2_EKA_W10
PEU_W03	Describes the basic tools and paradigms of object-oriented programming.	K2_EKA_W10
In terms of skills		
PEU_U01	Creates and executes source code parts containing constructor definitions in base and derived classes.	K2_EKA_U06
PEU_U02	Creates and executes parts of source code containing virtual functions and overloaded operators.	K2_EKA_U06

Program content ensuring learning outcomes

The subject covers the principles of object-oriented programming, its engineering and methodology. As a result of the subject, the student will know how to prepare the source code of a program using the object-oriented approach.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	30
Laboratory	30
Preparaton for classes	10
Preparation for an exam/credit	5
Self-study of class topics	18
Self-development of practical skills	7
Student workload	**Hours** 100

Wrocław University of Science and Technology

Optics and Nonlinear Optics

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Elective
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 3	• Lecture: 15 h, 1 ECTS, Graded credit • Classes: 15 h, 1 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Distinguishes issues in geometric and wave optics; classifies optical elements; lists and interprets phenomena of nonlinear optics, including those involving optical fibers	K2_EKA_W04
In terms of skills		
PEU_U01	Performs calculations in optical phenomena such as reflection and transmission of light, polarization of light, birefringence, interferometry, dispersion, diffraction and Fourier optics	K2_EKA_U08

Program content ensuring learning outcomes

Advanced geometric and wave optics, and the phenomena of nonlinear optics. Nonlinear effects observed in optics, including fiber optics, will be explained. Participation in the subject will enable the student to acquire the ability to perform calculations for optical phenomena such as reflection and transmission of light, polarization of light, birefringence,

interferometry, diffraction and Fourier optics.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	15
Classes	15
Preparaton for classes	15
Preparation for an exam/credit	5
Student workload	**Hours** 50

Wrocław University of Science and Technology

IoT Modules

Educational subject description sheet

Basic information

Field of study elektronika w języku angielskim	**Education cycle** 2026/2027
Speciality Advanced Applied Electronics	**Lecture languages** English
Organizational unit Faculty of Electronics, Photonics and Microsystems	**Mandatoriness** Elective
Study level second degree 3 semesters	**Block** Specialty subjects
Study form full-time studies	**Subject related to scientific research** Yes
Education profile general academic profile	

Semester	**Activities, hours, ECTS and examination**
Semester 3	• Lecture: 15 h, 1 ECTS, Graded credit • Project: 15 h, 1 ECTS, Graded credit

Subject's learning outcomes

Subject's outcome	Content	Learning outcome
In terms of knowledge		
PEU_W01	Characterizes the methods of wireless data transmission.	K2_EKA_W08
PEU_W02	Selects a wireless communication module that uses a specific transmission protocol.	K2_EKA_W08
In terms of skills		
PEU_U01	Implements the correct communication protocol depending on application requirements.	K2_EKA_U06
PEU_U02	Uses practically electronic modules for the construction of the device transmitting /receiving wireless data path.	K2_EKA_U06

Program content ensuring learning outcomes

Learning methods of wireless communication between electronic modules. Gaining design skills of designing electronic module for wireless data exchange.

Calculation of ECTS points

Activity form	**Activity hours**
Lecture	15
Project	15
Preparaton for classes	5
Preparation of a report/summary/presentation/paper	5
Preparation for an exam/credit	4
Conducting literature research	3
Self-development of practical skills	3
Student workload	**Hours** 50