Studies programme part 1

General characteristics of studies	
Main area (specialisation) of the studies:	**Institute of Informatics and Mechatronics**
The area (specialisation) of the studies *(the name of the area (specialisation) must be appropriate to the contents of the programme and*	**Computer engineering and mechatronics**
Level of education: *(first and second degree studies, uniform master degree studies)*	**first degree studies**
Educational profile:	**applied profile**
Mode of studies:	**full-time studies**
Number of semesters:	**7**
Training (total length):	**960 hours by the end of 7 semester**
OHS training in the following extent:	**8 hours at the beginning of 1 semester, performed as part of module Occupational safety and ergonomics**
Number of ECTS credits necessary to obtain qualifications corresponding to the level of study	**210**
Total number of ECTS credits obtained:	
in classes that require the direct participation of academic teachers or other lecturers:	**115**
in the course of classes in the humanities or social sciences:	**18**
as part of the training:	**32,5**
as part of the modules of classes related to practical professional preparation:	**167**
for classes conducted in a remote system (applies to studies in a remote system):	
Percentage proportion of ECTS credits for each discipline (concerns a major assigned to more than one discipline):	
leading discipline:: automatics, electronics and electrical engineering	**63 % - 63 % of the total number of ECTS credits**
discipline (disciplines) : technical computer science and telecommunication	**21 % - 21 % of the total number of ECTS credits**
discipline (disciplines):: mechanical engineering	**16 % - 16 % of the total number of ECTS credits**
Total student workload	**5563**
Professional title obtained by a graduate:	**engineer**
Indication whether the opinions of interested parties were taken into account in the process of defining learning outcomes and in the process of preparing and improving the programme *(indicate with whom employers the agreements are signed, meetings have taken place; how are the graduates monitored, etc.)*	**Innovlabs sp z o.o.; Logon SA; Asseco Poland S.A.**
Prerequisites (expected competences of the candidate - especially in case of second degree studies)	**Knowledge of the English language at the B2 level**
Area (specialisation) - major relation	**Mechatronics**

Studies programme part 1

Area (specialisation): **Computer engineering and mechatronics**

Educational modules	Subjects (* - shall mean the subject possible for selection)	Assumed learning outcomes	Programme content for achieving learning outcomes	Credit rigor	Number of ECTS	Ways of verifying the assumed learning outcomes achieved by the student
Canon subjects						
Selected issues of economics and entrepreneurship	Selected issues of economics and entrepreneurship	K_W12, K_W13, K_W15, K_U13, K_K06	Selected topics of marketing; Selected elements of organizational culture; Elements of economical analysis; Business plan using LEAN Canvas method.	Z	1	E-learning platform test, written assignments, teacher and group evaluation
Occupational safety and ergonomics	Occupational Health and safety training	K_W15, K_U11	Characteristics of labour protection system in Poland; The scope of OSH and definition of basic concepts in OSH; The principles of fire protecion; Characteristics of environmental protection; Basic issues on pollution; Utilization, biodegradation and recycling; Activities related to: spatial structure of the workplace, lighting and colors in work environment; Elements of control and system over the legal protection of health and safety at work	Z	0	E-learning platform test
Fundamentals of law and the protection of intellectual property	Fundamentals of law and the protection of intellectual property	K_W11, K_K02	The concept of law and its functions; Concepts, legal system and other normative systems; Legal standards; Law creation and hierarchy of law sources; Interpretation of the law; Characteristics of the basic branches of law; Intellectual property and its place in the legal system; Copyright personal and property rights; Protection of industrial property; Utility models, industrial designs, trademarks; Topography of integrated circuits, geographical indications.	Zo	1	E-learning platform test
Modern technologies	Basics of distance learning	K_W10, K_K01	Lifelong learning - the pace of changes in the surrounding world, methods of professional self-improvement; IT systems security - logging into WSG systems, elements of network security; Working with LMS system - places where information appears, sources of knowledge, communication methods, verifying learning outcomes	Z	0	Tests, polls, forum discussion
Culutres of the world	Culutres of the world	K_W13, K_U18, K_U20, K_K05	I. Basic issues in the field of cultural knowledge; discussion of representative concepts of culture; "history" of culture - presentation of selected concepts regarding the emergence of the cultural phenomenon. II. The concept of civilization; discussion of basic theories regarding the formation of civilization and mutual rela-tions between civilization and culture on the example of selected world cultures. III. Cultural criticism; historical aspects of the concept of "culture and power" on the example of post-colonialism. Relations, hegemonies, social inequalities in correlation to world cultures. Diversity of cultures and their dynam-ics. The concept of "cultural circle" and the axiological core and the concept of subculture. IV. Determinants of cultural identity and defining its essence; ethnicity and nationality. V. Magic, ritual and religion. VI. Europe as a political, ideological, cultural "concept" and as a way of thinking - its statics and dynamics. Other homogeneous, homeostatic and heterogeneous culture systems in terms of their expansion.	Z	1	Discussion during lectures, active participation in games and debates, Final assessment with a positive result (min. 60%). Online test.
Key social competence	Inclusive educatuon	K_K05, K_K07	The specificity of Polish and European culture compared to the cultures of other countries and continents; The specificity of the functioning of the academic culture in order to adapt students	Z	0	Multimedia presentation
Regionalism	Regionalism	K_W13, K_U10, K_K03	Definicje regionalizmu, Tożsamość regionalna, Tożsamość lokalna, Historyczne uwarunkowania ruchów regionalistycznych, Region jako podstawa identyfikacji społecznej i kulturowej , Społeczna rola regionalistów, Historyczne uwarunkowania tworzenia się regionalnego i lokalnego dziedzictwa kulturowego, Dziedzictwo regionalne i lokalne w tworzeniu lokalnego produktu turystycznego, umacnianie tożsamości regionalnej w działalności samorządów lokalnych, Wybrane zagadnienie z historii kształtowania się regionów Polski, Regionalizm w polityce kulturalnej Unii Europejskiej, Regionalizm jako potencjał endogeniczny województwa kujawsko-pomorskiego, Systemy wsparcie potencjałów endogenicznych w kontekście I kongresu regionalistów Kujaw i Pomorza.	Z	2	Tasks completed during classes , Homework, Attendance, Activities in classes - debates or written work.
Foreign Language	Foreign Language	K_U06, K_U17	Employees, names of occupations and positions; scope of professional activities and duties; company profile; description of products and services; vocabulary related to the sale and purchase, services, expressions for making complaints; production process, stages; team building, employee relations, supervisor relations; regulations and rules; forms of employment, running own business; first meetings and greetings; making phone calls; creating the company logo and image; time management; business meetings and meetings, tele and video conferences; delegating tasks and responsibilities; professional experience, professional achievements, labor market; recruitment process, job interviews, professional career; advertising of products and services; product technical specifications; product appearance and design, utility objects and buildings; work clothes, clothes and fashion; appearance and clothing, adjectives describing character and personality, character traits useful at work; use of various means of transport, commuting; description of the place of residence, large and attractive cities, life, problems and free time in the city; travel, tourist information, business travel, accommodation, travel problems, at the hotel; trips, sightseeing, orientation, tourist attractions; cultural heritage, intercultural communication, culture shock; cultural, entertainment, recreational and corporate events, fairs and exhibitions, events; work outside the country; interests, vocabulary related to leisure activities; meals, eating habits, diets, preparing and ordering meals and drinks, meals outside the home; changes in lifestyle and work, their pace and impact on people, maintaining balance between private and professional life, being assertive; vocabulary related to discoveries and inventions; technological innovations and solutions, names of electronic devices and gadgets, vocabulary related to the use of electronic devices and the Internet, information and communication technologies, social media, their use by companies, professional profile in social media; network security; vocabulary related to ecological behavior, threat and protection of the natural environment by using water, energy; money and finance, saving and spending money, financial settlements; describing trends, trends and changes, cause and effect relations; describing charts; public speaking, presentation elements, successful and unsuccessful presentations.	Zo	6	essay, grammar test; lexical test; oral expression; participation in the discussion; role play; tasks for understanding the written text; tasks for comprehension of the listened text; performing tasks on the e-learning platform

	Specialist foreign language	K_U06, K_U17	1.Repeat and record the grammatical basic level; 2.Present Simple Tense and The Present Continuous Tense vocabulary as a daily life in the context of a future job - an IT engineer; 3.Simple reconstitution and fixation of the past time (The Past Tense, The Past Continuous Tense); Terms of Reference for mechatronical issues; 4.Provide information on work-related work; Repeat the work safety and health and safety legislation vocabulary; 5.5.Repeat, record and supplement passive and vocabulary messages related to automation devices (construction, operation) with the practical application of the passive side and the speech in situational SCENES concerning the work station; 6. Preservation and replenishment of the specialist vocabulary for the operation and operation of equipment and machines.	Z	2	Essay; oral expression; tasks for comprehension of technical written text; tasks for the comprehension of the listened technical text.
Physical education	Physical Education	K_U20	Team games; General development classes with elements of basketball, volleyball, handball, football, floorball; Fitness	Z	0	Test; self-assessment, analysis, observation
Practical philosophy	Ethics of Artificial Intelligence	K_W13, K_U18, K_U20, K_U10, K_K01	Introduction, or – on everything we need to know to get started . Algorithms and how they ru(i)n our lives. AI in popculture . Moral Dilemmas and thought experiments in AI . Current trends in AI research . Machine consciousness, humor, emotions and... common sense.	Z	1,5	E-learning platform test
	Ethics	K_W13, K_K07	Ethics as a science; Teleologism in ethics; Moral norm; A person as a source of morality; Conscience as a norm of morality; Ethics in the contemporary challenges	Zo	1	essay; test
Flexible education	Introduction to scientific information	K_U01, K_U05	Definition of information and its application in science; Sources of scientific information; Catalogs and bibliographic databases; Scientific databases; Licensed online knowledge databases; Open Repositories; Finding information using Internet; Use of scientific search engines; Using multi-search engines; Use of library information and search systems	Z	1	E-learning platform test
	Library Training	K_U05, K_U01	WSG information and library system; WSG Main Library (or affiliate libraries) and its collections in the Internet; On-line catalogs; Providing access to collections; Databases	Z	0	E-learning platform test
	Pre-Medical First Aid	K_U20	Cardiopulmonary resuscitation; Injured and unconscious person; Respiratory obstruction; Life threatening states associated with the nervous system. Symptoms and conduct; Diseases and emergencies requiring assistance related to the respiratory system, cardiovascular system. Symptoms and conduct; Frostbite, thermal burns, chemical burns, electric shock; Types of wounds and their supplies, hemorrhages; Injuries of the musculoskeletal system, head, spine; Management in various life-threatening conditions and diseases. Symptoms and conducts	Z	1	Test; tasks; observation of students' work, evaluation and analysis of exercises
	Specialist IT systems	K_U14, K_W06	1. Working with Microsfot Visio: Creating UML diagrams using Visio; Application of templates; Connecting to data sources; Advanced Visio features; 2. Microsoft Project: Organization of work in MS Project; Creating teamwork schedules in MS Project; Advanced schedule formatting	Z	1	Activity in laboratory classes, passing individual laboratory exercises.E-learning platform test
	Polish Language Culture	K_U18	Developing listening, speaking, reading and writing skills within the scope of everyday life and basic social contacts - establishing and maintaining contact in official and unofficial situations, providing information about yourself, shopping, using gastronomic services, transport and accommodation, expressing basic needs in the above situations	Zo	4	essay, grammar test; lexical test; oral expression; participation in the discussion; role play; tasks for understanding the written text; tasks for comprehension of the listened text; performing tasks on the e-learning platform
	Basic Engineering Course	K_W09, K_U09	1. Introduction to Matlab environment; 2. Introduction to Arduino; 3. Robot movement - open-loop controller. Cause the robot to drive in a straight line, a circle, a rectangle; 4. Line following task. Reading values from line sensors on the under-side of the robot. Sensor calibration; 5. Robot movement - closed-loop system. Use encoders encoder attached to the motor shafts to improve robot behavior; 6. Distance sensors. Reading values from bump sensors and the distance sensors(optical, ultrasonic); 7. Obstacle avoidance. Write code to drive robot while avoiding crashing into the objects in front. Write code to drive along the wall; 8. Mapping. Maze exploration - write code to explore a maze and find the center. Find shortest path in a maze; 9. Inertial navigation. Use acceleration sensor to calculate robot speed and position; 10. Advanced navigation(GPS); 11. Kalman filtering. Write a code to implement Kalman filter to improve motion parameters estimation.	Zo	4	Activity in laboratory classes, passing individual laboratory exercises.
	Electronics	K_W05, K_W08, K_U08	1. Basic concepts of electronics; 2. Basics of circuit theory - Ohm's law, Kirchhoff's law, Thevenin and Norton principles; 3. Resistors and calculations of circuits containing resistors, voltage sources and current sources. Different types of resistors, power resistors, potentiometers; 4. Capacitors and calculations of circuits containing capacitors. Different types of capacitors, variable capacitors; 5. Coils and calculations of circuits containing coils. Different types of coils, variable coils; 6. Low-pass, high-pass and band-pass filters, low-stop, high-stop and band-stop filters; 7. Introduction to the PSpice simulation environment; 8. Simulations of DC and AC circuits in the PSpice environment; 9. Basics of semiconductors; 10. Semiconductor diodes: rectifying diodes, a half-wave rectifier, a full-wave rectifier, a bridge full-wave rectifier. Rectifiers with a capacitor filter; 11. Zener diodes. Rectifiers with a Zener diode; 12. LED diodes, LED-RGB; 13. Bipolar transistors (NPN, PNP): structure and operation, examples of applications; 14. Transistor amplifiers using bipolar transistors; 15. Integrated operational amplifiers (OpAmps) and their applications; 16. MOSFET transistors: NMOS and PMOS: structure and operation, examples of applications; 17. CMOS technology: inverter, NAND, NOR, AND, OR and XOR gates; 18. Selected measurements of physical quantities using electronic devices.	E/Zo	5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.

	Subject	Codes	Content	Form	ECTS	Assessment
Basic subjects	Physics	K_W01, K_U08	1. Measurement; 2. Motion In A Straight Line; 3. Motion in A Plane; 4. Laws of Motion; 5. Work, Energy and Power; 6. Systems of Particles And Rotational Motion; 7. Gravitation; 8. Mechanical Properties of Solids; 9. Mechanical Properties of Fluids; 10. Thermal Properties of Matter; 11. Thermodynamics; 12. Kinetic Theory; 13. Oscillations; 14. Waves	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Mathematics	K_W01, K_U09	1. Functions; 2. Matrix and Linear Algebra; 3. Vectors and Tensors; 4. Limits and Derivatives; 5. Differentiation Rules; 6. Applications of Differentiation; 7. Numerical and Functional Infinite Series; 8. Differentiation of Multi-Variable Function; 9. Integrals ; 10. Techniques of Integration; 11. Applications of Integration; 12. Multiple Integrals; 13. Ordinary Differential Equations; 14. Introduction to Partial Differential Equations; 15. Complex Numbers; 16. Laplace Transformation and its Applications ; 17. Fourier Transformation and its Applications ; 18. Numerical Methods	E/Zo	10,5	Assessment of activity in the classroom, Assessment of the implementation of tasks on individual topics
	Control Theory	K_W05, K_W08, K_U08, K_U14, K_U15	1. Introduction to control engineering; 2. System modelling; 3. Time domain analysis; 4. Introduction to closed-loop control systems; 5. Design in the s-plane; 6. Design in the frequency domain; 7. Digital control systems design; 8. State-space methods; 9. Optimal control system design	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Strength of materials	K_W03, K_W09, K_U02, K_U16, K_K02	1. Compendium of knowledge on materials; 2. Elements of classical mechanics as related to strength of materials; 3. Mechanical properties of materials in continuum approximation; 4. Basic terms in strength of materials; 5. Tension and compression; 6. Strength parameters and determination of strength parameters by experimental methods; 7. Types of loads and stresses; 8. Bending of the beams 9. Analysis of the planar beam systems; 10. Determination of the stresses in systems of diverse configurations and at odd loadings; 11. Yield criteria; 12. Determination of the stress state by energy methods ; 13. Fundamentals of fracture mechanics; 14. Statics and examples of loadings in various geometrical configurations	E	2,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Control Engineering	K_W05, K_U08, K_U14 , K_U15	1. Introduction to assisted steering: The essence of assisted steering; Classification of assisted steering systems; Steering and management; 2. Dynamic systems models and methods of analysis: Traffic equation; operator and spectral transmission; State space; 3. Automation Components: Regulators and Controllers; Sensors and Measurement Transducers; Drives, Position Control, Servo Engines; 4. Automation design: Automatic system stability; Governor settings; Status feel; polarity reversals, state monitors; 5. Switching Systems: Combination Systems; SFC Graphs; PLC Drivers; 6. Industrial automation systems: Specificity of real-time systems; Real-time operating systems; Industrial networks - SCADA systems; Distributed automation systems	Zo	3,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Major and area-related subjects						
	IT Technologies	K_W04, K_U07	The basic concepts of information technology (information technology, information technology, information society, information, communication, Internet, e-learning). TI hardware considerations (external devices, central processing unit, optimal hardware configuration for your computer), computer applications (types of computer programs, basic software set, licenses), and computer networks. Internet benefits and threats. E-learning content, tools and practice. Create text documents in-house, create a simple analysis of data and interpret them in a graph, a multimedia presentation that will be useful for content from other subjects, and then as part of a student's work.	Z	1,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Metrology	K_W01, K_W05, K_U08, K_U15	1. Fundamentals of metrology - quantities and their measures, units, basic concepts. 2. Measurement systems - measurement accuracy, error and uncertainty. International standards for measurement uncertainty. 3. Uncertainty propagation in measurements. 4. Measurement methods - classification and description. Selection of measurement methods due to legal requirements. 5. Signal collection and processing. Measurement of electrical and mechanical quantities. Methods of measuring electrical and mechanical quantities in service practice. 6. Coordinate metrology - selection of measuring instruments. 7. Optical measurement of geometrical quantities. 8. Monitoring the accuracy of measuring instruments. Calibration of measuring instruments. Instrument management in a measuring laboratory.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises.
	Materials science	K_W02, K_U09, K_U13, K_U15	1. Rules for the selection of engineering materials in the construction of machines and devices; 2. Basics of material selection for products and their components; 3. Properties of materials depending on phase structure and microstructure; 4. Alloy steels with special properties; 5. Powder metallurgy as a technology of materials and finished products; 6. Formation of the structure and properties of surface layers; 7. Elements of facts and changes in the structure of engineering materials as a result of exploitation	E	2	Written Tests
	Statistics and probability	K_W01, K_U09	Basic statistical concepts. Development of statistical material. Structural analysis. Probability calculus. Basics of estimation theory. Basics of hypothesis verification. Distribution of a random two-dimensional variable	Zo	3,5	Test

Subject	Learning outcomes	Content	Form	ECTS	Assessment
Computer networks	K_W04, K_W06, K_W09, K_U02, K_U05, K_U14	1. Review of network standards, RFC documents; 2. Basic configuration of network devices; 3.Preparation of Cat.5e network cabling; 4. Ethernet network construction using L2 managed switches, analysis of the dynamic process of building switching tables; 5.Analysis of frames in LAN and ARP protocol; 6.Connecting LANs using routers and leased lines; 7.Designing IPv4 addressing for organizations, subnet mask function, network address, broadcast address; 8.Dividing class networks into subnets with fixed mask lengths, subnet aggregation; 9.Configuration of IP routers, analysis of routing tables; 10.ICMP protocol operation - ping and traceroute commands; 11.Configuring the default gateway in a LAN; 12.Tracing the route of IPv4 packets to the destination network; 13.Analysis of TCP and UDP protocols using the WireShark application, analysis of transport layer headers; 14. TCP / IP protocol stack; 15. Analysis of application layer protocols: http, pop3, telnet, ssh, etc.; 16.Network Documentation; 17. Introduction to computer network simulation.	Zo	3,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Programming	K_W04, K_W06 K_U02, K_U05, K_U15	1. Visual Studio; 2. Anatomy of a Simple Program; 3. Compilation and Debugging ; 4. Creating Projects and Solutions; 5. Basic keywords; 6. Types of variables; 7. Arithmetical operations on variables; 8. Statements and Expressions; 9. Arrays (1-D, and 2-D); 10. Lists; 11. Structs; 12. Functions ; 13. Files and streaming	Zo	3	Final test, active Activity in laboratory classes. Assessment of the performance of individual programming tasks
Computer Aided Design	K_W07, K_U02, K_U07	1. Solid Modeling: parts, sheet metal parts; 2. Surface modeling: parts, sheet metal parts; 3. Creating 3D documentation of assemblies; 4. Creating 2D documentation of assemblies; 5. Creating 2D executive documentation; 6. Frames; 7. Weldment construction	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
Computer systems architecture	K_W06, K_U16	1. the essence of computer systems organization and architecture: short of computer evolution and history; 2. lewel of virtual computers; 3. structure of von Neumann computer (IAS); 4. generations of computer technogy; 5. coplement number systems; 6. floating-point numbers; 7. IEEE-754 Standard; 8. binary codes; 9. representation of numbers; 10. arrays and records; 11. a simple computer (data format, instruction format; 12. instruction fetch; 13. instruction execution, instruction set; 14. addressing modes, other addressing modes; 15. address calculations, assemblering); 16. organization of memory systems ((S/D)RAM, LIFO/FIFO; 17. cache and stack memories; 18. (EP)ROM); 19. organization of input/output system (system bus, address bus, control bus, data bus, bus structure; 20. (a)synchronous transmissions,; 21. tristate driver); 22. arithmetic and logic unit,; 23. control unit; 24. organization of simple (micro)processor (CPU); 25. instruction list (CPU, CU); 26. principles of assembler language; 27. interrupt system (hardware and software); 28. CISC and RISC architecture conception; 29. short information about: superscalar system, vector computer (processor), operation systems (DOS, UNIX, BIOS).	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Object-Oriented Programming	K_W04, K_W06 K_U02, K_U05, K_U15	1. Introduction to object-oriented programming; 2. Classes (static members, static classes, Reference Types); 3. Members of classes ; 4. Interfaces; 5. Inheritance; 6. Method overloading ; 7. Virtual methods; 8. Abstract classes and methods; 9. Object Lifetime; 10. Exceptions; 11. Delegates; 12. Lambdas	Zo	3,5	Final test, active Activity in laboratory classes. Assessment of the performance of individual programming tasks
Advanced Computer Aided Design	K_W07, K_U02, K_U07	1. Advanced solid modeling: parts, sheet metal parts; 2. Advanced surface modeling: parts, sheet metal parts; 3. Creating 3D documentation of assemblies (advanced); 4. Creating 2D documentation of assemblies (advanced); 5. Creating 2D executive documentation; 6. Advanced frames; 7. Advanced weldment construction	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
Advanced Computer Networks	K_W04, K_W06, K_W09, K_U02, K_U05, K_U14	1. Introduction: Router construction and operation, static routing, distance vector routing protocols, link-state routing protocols, summarized routes, and default routes; 2. Configuring RIPv2: Methods to Prevent Routing Loops RIP timers. Protocol limitations for discontiguous networks. Propagate default route in the RIP domain. Protocol configuration; 3. RIPv2: Routing Protocol Behavior with CIDR and VLSM Redistribute directly connected networks and static routes. Configure the protocol; 4. Routing Table Analysis: Hierarchical routing table structure. Classful and classless routing table lookup; 5. EIGRP: Configure the protocol. EIGRP metric; 6. OSPF: Configure OSPF in one area. OSPF metric.	Zo	1,5	Final test, active Activity in laboratory classes. Assessment of the performance of individual programming tasks
Digital Circuits	K_W05, K_W08, K_U08	1. Electric Circuit Theory Review; 2. Digital and Analog.; 3. Number Systems; 4. Common Logic Gates : AND, OR, NOT gates, ICs.; 5. Common Logic Gates (II): NAND, NOR. ICs, Troubleshooting; 6. Combinational Logic. Theorems of Boolean Algebra. DeMorgan's Theorem. The Uniting Theorem; 7. NAND/NOR Universality. ; 8. XOR, XNOR, Parity Circuits; 9. Boolean Cubes. Mapping Truth Tables onto Boolean Cubes; 10. Karnaugh Maps; 11. Binary Addition and Subtraction, Two's Complement System and Arithmetic, BCD Arithmetic, Half and Full Adders, Adder ICs, Adder/Subtractor, ALU; 12. Comparators, Decoding/Encoding, Code Converters, MUXs, DeMUXs; 13. Hazards; 14. A Sequential System; 15. Sequential Logic; Registers; SR Latch; D, JK, T Flip Flops; MS and Edge Triggering; IC Flip Flops; Octal FF chip; FF Function Tables; 16. Sequential Circuit Analysis, Ripple Counters, Modulus, Divide-by-n Counters,; 17. Synchronous Counters; 18. TTL Family, Totem Pole and Open Collector Outputs, CMOS Family, Interfacing Logic Families, Auto Delay Gate, Auto Reset Circuit, Schmitt Trigger, Debouncing, Pull-up Resistors; 19. Introduction to PLD; 20. Introduction to VHDL.	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.

Module	Course	Codes	Content	Form	ECTS	Assessment
Module A	PHP Programming	K_W04, K_W06 K_U02, K_U05, K_U15	1. Introduction to PHP scripting language, working with variables, arrays, loops and sets of data; 2. Designing relational databases for MySQL using phpMyAd-min, creating tables, constraints, views and MySQL queries; 3. Model of a client-server web application; 4. Programming web applications using object-oriented PHP and MySQL database; 5. Using HTML and Cascade Style Sheets to present data and create forms; 6. Working with various types of HTTP requests to communicate between client and server.	Zo	2,5	Final test, active Activity in laboratory classes. Assessment of the performance of individual programming tasks
	Databases	K_W04, K_W06, K_U02	1. Introduction to Basic Database Concepts; 2. Database Architecture. Database Planning; 3. Data Storage Mechanisms; 4. Process of Database Design; 5. Relational Database; 6. Conceptual Data Modeling; 7. Entity Relationship Diagram; 8. Entities, Attributes and Relationship; 9. EER Diagram; 10. Normalization and Denormalization; 11. SQL as a database language: DML constructs in SQL: SELECT phrase as a specification of a se-quence of operations on tables; 12. Syntax and semantics of basic SELECT phrases, conceptual processing order of sections (clauses); 13. Acceptable expressions in particular clauses; 14. Nested constructs: correlated and uncorrelated sub-queries; 15. Principles of formulating queries in the form of SELECT expressions: equivalent forms; 16. Declarative and procedural semantics of the SELECT expressions; 17. Three-valued logic in SQL: a problem of NULL values, anomalies resulting from NULL values; 18. Designing relational databases - revisited Notion of a key of relation, functional dependencies, Armstrong axioms, schemata decomposition, normal forms 1NF, 2NF, and 3NF, normalization of relational schema; 19. Multivalued dependencies, 4NF. Mapping of ER to relational model; 20. Defining domain and semantic integrity constraints; 21. Description of database structure by means of data dictionary; 22. Physical level of data: Record storage formats, storage of fixed length and variable length data, indexing structures, primary and secondary indexes, hash coding, ISAM, B-tree family data struc-tures, operations on the indexes; 23. Transaction processing : the concept of transaction, state diagram for transaction execution (commit, rollback, etc.), execution schedule, serializability of the schedule, testing serializability, concurrency control, locking mechanisms, protocols , time stamping	Zo	3	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
	Modern Power Supply Systems	K_W05, K_W08, K_U16, K_U17	1. The essentials of electric shock protection, earthing systems and RCDs (Residual-Current Devices); 2. Electric power generation and transmission; 3. Power network systems; 4. Three-phase electric power; 5. Voltage regulators, regulated power supplies; 6. Types of rectifiers. Types of rectifier filters; 7. Linear voltage regulators versus switching regulators; 8. Cooling methods for voltage regulators. Cooling systems for voltage regulators calculations and designing. How temperature affects mean time to failure (MTTF)?; 9. Introduction to modern power supply systems; 10. DC-DC step-up, step-down, step-up-and-down converters characteristics, testing and designing; 11. ATX power supply units characteristics and testing; 12. Buffer power supply units. Buffer power supply system designing; 13. Modern power supply units testing: short circuit protection testing, overload limits testing, efficiency testing; 14. Modern power supply designing.	Zo	1,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Computer Measurements Systems	K_W01, K_W05, K_U08	1. Introduction to computer measurement systems; 2. Wired and wireless measuring systems; 3. Hardware platforms for computer measurement systems; 4. Arduino platform examples and features. Wired and wireless data transmissions; 5. Computer measurement system design based on Arduino Ethernet and Arduino WIFI platforms; 6. Raspberry Pi platforms – models comparison, peripherals, characteristics, features, software, operating systems; 7. Computer measurement system design based on Raspberry Pi platform; 8. PLC platforms – Siemens LOGO controller family – models comparison, peripherals, characteristics, features, software; 9. Computer measurement system design based on LOGO!8 platform; 10. LabVIEW software and hardware; 11. Computer measurement system design based on LabVIEW software and hardware; 12. Selected measurements of physical quantities with the help of electronic devices - light meters (photoresistor, photodiode, phototransistor) sound/noise meters, temperature meters, air quality meters, distance meters, pressure meters and others; 13. Introduction to IoT technology; 14. Industry 4.0.	Zo	1,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Project Management	K_W15, K_U15, K_U18, K_K07	1. An Overview of Project Management ; 2. Planning the Project; 3. Developing a Mission, Vision, Goals,and Objectives for the Project ; 4. Creating the Project Risk Plan ; 5.Using the Work Breakdown Structure to Plan a Project ;6. Scheduling Project Work; 7.Producing a Workable Schedule; 8. Project Control and Evaluation; 9. The Change Control Process; 10. Project Control Using Earned Value Analysis; 11. Managing the Project Team.	Zo	3,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Robotics	K_W08, K_U02	1. Introduction to Matlab environment; 2. Introduction to Arduino; 3. Robot movement - open-loop controller; Cause the robot to drive in a straight line, a circle, a rectangle; 4. Line following task; Reading values from line sensors on the under-side of the robot; Sensor calibration; 5. Robot movement - closed-loop system; Use encoders encoder attached to the motor shafts to improve robot behavior; 6. Distance sensors; Reading values from bump sensors and the distance sensors(optical, ultrasonic); 7. Obstacle avoidance; Write code to drive robot while avoiding crashing into the objects in front; Write code to drive along the wall; 8. Mapping; Maze exploration - write code to explore a maze and find the center; Find shortest path in a maze; 9. Inertial navigation; Use acceleration sensor to calculate robot speed and position; 10. Advanced navigation(GPS); 11. Kalman filtering; Write a code to implement Kalman filter to improve motion parameters estimation	Zo	4	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.

Course	Learning outcomes	Content	Form	ECTS	Assessment
Elements of Mechanical Design	K_W02, K_W03, K_W07, K_W09,K_U02, K_U16, K_K02	1 The Nature of Mechanical Design ; 2 Materials in Mechanical Design ; 3 Stress and Deformation Analysis ; 4 Combined Stresses ; 5 Design for Different Types of Loading; 6 Columns ; 7 Belt Drives and Chain Drives ; 8 Kinematics of Gears ; 9 Spur Gear Design; 10 Helical Gears, Bevel Gears, and Wormgearing ; 11 Keys, Couplings, and Seals; 12 Shaft Design ; 13 Tolerances and Fits; 14 Rolling Contact Bearings ; 15 Completion of the Design of a Power Transmission; 16 Plain Surface Bearings; 17 Linear Motion Elements; 18 Springs; 19 Fasteners; 20 Machine Frames, Bolted Connections, and Welded Joints ; 21 Electric Motors and Controls; 22 Motion Control: Clutches and Brakes	Zo	2	Written exam, Assessment of activity in the classroom, Assessment of exercises.
Energy Harvesting	K_W05, K_U08	1.Introduction to energy harvesting: Power supply system for electronic devices, Energy vs power, Piezoelectric transducers., Thermo generators. Solar cells, Fuel cells, Power management, 2.Energy storage: Battery basics, Battery chemistries, Battery specifications, Battery charging, Battery selection for application requirements., Ultracapacitors, Numerical simulation of an electrical energy storage system; 3.Application examples: Power sources for wireless sensor networks, Energy harvesting for ID tags, Battery-free wireless light switch, Energy harvesting for medical applications, Smart clothes.	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Technical mechanics	K_W03, K_W09, K_U02, K_U16, K_K02	1. Introduction; 2. Reduction of the system of forces; 3. Friction; 4. Mechanical geometry of plane figures and masses; 5. Internal forces in mechanical systems	E/Zo	3,5	Exam, test
Internet of things	K_W04, K_W06, K_U02, K_U14, K_U15	1.Introduction to IOT: definition of IOT, Industry 4.0 and Industrial Internet of Things, Internet of Medical Devices (IOMT), design rules for IOT systems and devices, security in IOT systems, ethics and law in Internet of Things world; 2.Communication interface for IOT: 802.11 based solutions, LoRa, LoRaWAN, Sigfox, 6LoWPAN, NB-IOT, 3. IOT devices prototyping: hardware platforms, MQTT protocol, AMQP protocol, JSON data exchange standard; 4.Platforms and tools for data visualization: NodeRED, ThingsSpeak. 5.Applications examples: smart clothes, home automation/smart buildings – house access control, sensor networks – ar quality, environmental measurement systems, PV monitoring system, health monitoring system.	E/Zo	3,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
User Interface Design	K_W04, K_W08, K_U02, K_U16	1. Basic concepts related to raster and vector graphics; 2. Introducing graphic design software such as Adobe Pho-toshop and Affinity Designer; 3. Usage of layers, masks, transforms, curves, Blend Modes, Adjustments and Effects; 4. Layout elements on websites, mobile applications, desktop programs; 5. Creating concepts of user experience; 6. Sketching and prototyping UI elements; 7. Designing user interfaces; 8. Usage of third-party components (icons, stock images, fonts, etc.).	Zo	3,5	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
Digital Signal Processing	K_W05, K_U02, K_U09, K_U14, K_U15	1. Digital filtration; 2. Correlation analysis and matched filtration; 3. Frequency signal processing - DFT, DCT, DST; 4.Time-frequency processing - Transformats: STFT, Hilbert, Gabor, Wavelet, Sizing DFT; 5. Data compression and synchronization basics of digital signal processing and the structure of digital data communication systems.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Numerical methods	K_W04, K_W06, K_U09	1. Matlab and Solving Equations; 2. Linear Algebra; 3. Functions and Data; 4. Differential Equations	Zo	2	Final test, active Activity in laboratory classes. Assessment of the performance of individual programming tasks
Programmable Logic Controllers	K_W05, K_W08, K_U08, K_U14, K_U15, K_U16	1. Architecture and operating principle of programmable controllers: PLC construction PLC block diagram; Programmable controller operating modes; Programmable controller specific times; Controller communication with timer; Driver memory map. Addressing Memory Areas; 2. Principles for linking programmable controllers to control objects: Power to programmable controllers; Types of PLC inputs Types of PLC outputs PLC inputs and outputs technical and performance specifications; Programmable device communication interfaces; Distributed Ethernet-based control configuration; 3. Ladder Language (LD) for Omron Drivers; Ticket Control Instructions. Logical instructions; timers and counters; Data transfer and copy operations. Arithmetic shifts and circular sets. Data comparison; subprograms. Program run control; Binary and BCD calculations. Data conversion; 4. Design and operation of programmable relays: Concept of programmable relay; Block diagram of programmable relay; Comparison of programmable relay with programmable controller; FBD language using the LOGO relay example; 5. Creating and software a user interface.	E	2	Written exam. Evaluation of the laboratory exercises. Assessment of work in a group.
Rapid Prototyping (3D Printing)	K_W02. K_W03, K_W07, K_U15	1. Introducing to prototyping; 2. Arduino and Raspberry Pi as a base for Rapid Prototyping; 3. Arduino IDE ; 4. Designing electronic devices: Fritzing software, Breadboards; 5. Building electronic devices; 6. Introducing to 3d Printing: Materials, Printers types, Using 3d pronter; 7. Designing 3D models; 8. Building own solutions	Zo	5,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Machine learning	K_W04, K_W05, K_W06, K_U09	1. Linear algebra review. Linear regression with one variable. Linear regression with multiple variables. 2. Naive Bayes. 3. Neural networks. 4. Support Vector Machines. 5. Decision trees. 6. Regularization. 7. Learning theory.	Zo	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Electrical machines	K_W05, K_W08, K_U13, K_U15, K_U16	1. Basic Design Considerations of Electrical Machines; 2. Design of Magnetic Circuits; 3. Design of Transformer; 4. Design of Three-phase Induction Motor; 5. Design of Single-phase Induction Motor; 6. Design of Synchronous Machine; 7. DC Machine	Zo	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Home automation systems	K_W05, K_W06, K_W08, K_U02, K_U05, K_U16	1. Communication protocols in home automation systems. 2. Tools and products used in home automation. 3. An overview of different home automation ecosystems 4. Designing a home automation implementation 5. AI and smart solutions in home automation.	Zo	3	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.

Module	Subject	Learning outcomes	Content	Form	ECTS	Assessment
Module B	Advanced Databases	K_W04, K_W06, K_U02	1. Designing relational databases - revisited Notion of a key of relation, functional dependencies, Armstrong axioms, schemata decomposition, normal forms 1NF, 2NF, and 3NF, normalization of relational schema; 2. Multivalued dependencies, 4NF. Mapping of ER to relational model; 3. Defining domain and semantic integrity constraints; 4. Description of database structure by means of data dictionary 5. Physical level of data: Record storage formats, storage of fixed length and variable length data, indexing structures, primary and secondary indexes, hash coding, ISAM, B-tree family data struc-tures, operations on the indexes; 6. Transaction processing : the concept of transaction, state diagram for transaction execution (commit, rollback, etc.), execution schedule, serializability of the schedule, testing serializability, concurrency control, locking mechanisms, protocols , time stamping	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Mobile Devices Programming	K_W04, K_W06, K_W08, K_U09, K_U15	1. Using Android UI objects: Buttons; EditTexts; TextViews; Layouts; Views; Events; 2. Communication inside Android application: Saving and reading data; Shared Preferences, Intents; 3. Creating synchronous and asynchrous methods in Android; 4. Using HTTP protocol for communication with remote Application Programming Interface (API): RESTful Web services; JSON data format; GET and POST methods; 5. Long-running background operations: Service; AlarmManager; 6. Google Maps SDK for Android: Getting API Key; Configuration; Using markers with popups; 7. Configuring and developing notifications under certain conditions	Zo	2,5	Final test, active Activity in laboratory classes. Assessment of the performance of individual programming tasks
	Renewable Energy Systems	K_W05, K_W08, K_U02	1. General principles of energy conversion. Renewable energy sources. Renewable energy potential; 2. Wind energy. Its conversion in wind turbine. Wind power station; 3. Biomass energy conversion systems; 4. Solar energy. Solar radiation conversion processes: photovoltaic conversion, solar thermal conversion, photoelectro-chemical conversion. Solar thermal electricity generators, solar power stations, solar collectors; 5. Geothermal energy; 6. Energy of water, hydro, tidal and wave energy conversion; 7. Electrochemical energy, fuel cells; 8. Integration of renewable energy sources to electrical power networks; 9. Economic problems. Choices, problems and opportunities.	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
	Embedded systems	K_W04, K_W05, K_W09, K_U02, K_U14, K_U16	1. Introduction to Embedded Systems; 2. Introduction to mbed and CooCox Platforms; 3. The ARM Cortex – M Processor Architecture; 4. ARM Cortex-M Programming; 5. Digital Outputs; 6. Digital Inputs; 7. Analog Inputs; 8. Timers. Input Capture. Output Compare. PWM; 9. Interrupts. Low Power Features; 10. Serial Communication; 11. Intefaces: CAN, HART, ModBus; 12. External Memories; 13. RTOS – Real Time Operating System	Zo	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Artificial intelligence	K_W04, K_U09	1. Search methods; 2. Strengthening learning; 3. Data classification methods; 4. Decision trees; 5. Bayesian networks; 6. Fuzzy systems; 7. Learning without reinforcement; 8. Grouping; 9. Genetic algorithms; 10. Regression; 11. Artificial neural networks	E	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Operating system	K_W06, K_U16	1. Basic terms and classifications; 2. Operating system kernel and process management; 3. Memory management; 4. Management of the I / O system; 5. File management; 6. User-system communication; 7. The tasks of the computer system operator; Tasks of a computer system administrator; 8. Programs for monitoring the work of the computer system and computer network; 9. General characteristics of contemporary operating systems: Unix, Linux, Windows.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Web Applications Programming	K_W04, K_W06 K_U02, K_U05, K_U15	1. Bootstrap as a front-end framework; 2. Development of Content Management System with PHP language; 3. JavaScript and jQuery library; 4. WYSIWYG Editors; 5. Developing a secure image upload; 6. Log-in system - session, cookies and user accounts; 7. Creating interactive tables with DataTables	Zo	3	Assessment of programming tasks, assessment of teamwork skills.
	Elective Subject : Fundamentals of machine component design	K_W03, K_W09, K_U02, K_U16, K_K02	1. Overview of the mechanical engineering design. 2. Load analysis. 3. Materials. 4. Static body stresses. 5. Elastic strain. Deflection. Stability 6. Impact. Fatigue. Surface damage. 7. Threads. 8. Rivets. Welding. Bonding. 9. Springs. 10. Lubrication. Bearing. 11. Gears. Shafts. Clutches and brakes. 12. Safety factors and reliability.	Zo	2	Assessment of individual tasks
	Elective Subject : Fundamenatls of machine operation	K_W03, K_W09, K_U02, K_U16, K_K02	1. Basic machine tools. Single and multi-point cutting tools. Tool geometry and materials. Tool life. Economics of machining. 2. Limits, fits, and tolerances. Linear and angular measurements. Gauges. Form and finish measurement. Alignment and testing methods. 3. Tolerance analysis in manufacturing and assembly. 4. Introduction to CAD/CAM tools.	Zo	2	Assessment of individual tasks
	Elective Subject : Industry Subject (AR technology)	K_W14, K_U15	1. Introduction to augmented and mixed reality technology; 2. Using Unity environment for multi-platform applications development;3. Environment configuration for augmented reality - usage and testing with AR/XR goggles: Google Daydream, Microsoft HoloLens; 4. Fast prototyping with assets; 5. Explanation of the terms GameObject, Camera, RayCast; 6. Developing scripts in C#. 7. Creating classes, properties, events; 9. Applying animations to objects' 10. Creating dynamic particles.	Zo	1	Assessment of individual tasks
	Elective Subject : Industry Subject (VR technology)	K_W14, K_U15	1. Introduction to virtual reality technology; 2. Using Unity environment for multi-platform applications development; 3. Environment configuration for virtual reality - usage and testing with VR goggles: Oculus Rift, HTC Vive, PS 4 VR.; 4. Fast prototyping with assets; 5. Explanation of the terms GameObject, Camera, RayCast; 6. Developing scripts in C#. 7. Creating classes, properties, events; 9. Applying animations to objects; 10. Creating dynamic particles.	Zo	1	Assessment of individual tasks
	Industry Subject	K_W03, K_U10	The content of the lecture depends on the topic of the lecture, which the student selects individually.	Zo	2	Test
	Power Electronics	K_W05, K_U02	1. Introduction; 2. Power Computations; 3. Half-Wave Rectifiers; 4. Full-Wave Rectifiers; 5. AC Voltage Controllers; 6. DC-DC Converters; 7. DC Power Supplies; 8. Inverters; 9. Resonant Converters	E	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports. Exam

	Components and Devices of Control Systems	K_W05, K_W08, K_U08, K_U14, K_U15	Classification of control systems. Controls, theory, feedback, selection of optimum PID control settings. Hardware and functional architecture of computer control systems, classification and characteristics of basic structures, hardware requirements of computer control systems in memory, computing power, interrupts, input/output circuits. Software for computer control systems, process variable collection and processing algorithms, input/output device support, human communication - system. Computer integrated control systems: Industrial PLC drivers, industrial computers, PC-based PLC industrial computers. Programmable logic controllers (PLC). Design of controllers, programming languages for drivers, logical diagram of the controller and its workflow. Layout and operation of modular industrial controllers using the SIMIC systems: Main unit, digital modules, analog inputs / outputs, special modules, counter systems. Communication systems. Memory map, special driver logs. Power supply to the controllers. Rules for use of controls, assembly, external connections.Distributed control, network control systems, industrial networks (CAN, Profibus, Profine). Communications protocols used in embedded systems: Wired (CAN, Ethernet) and Wireless (ZigBee). Monitoring and visualization systems and control of the superior SCADA.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Data transmission	K_W04, K_W05, K_U16	1. Parallel data transmission via PCI; 2. Serial USB data transmission; 3. Data transmission through the I2C coupling; 4. JTAG interface and TAP controller; 5. RFID radio frequency identification; 6. PowerLink transmission; 7. The use of an Internet network for communication with measurement and control systems; 8. Read and write data to magnetic and electronic cards; 9. Ways to protect data transmission from interference; 10. Identify the ModBus communication protocol in the RTU transmission mode that uses RS485 as the physical layer. ; 11. Fiber-optic transmission; 12. Infrared data transmission	E	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Control Systems Design	K_W05, K_W08, K_U08, K_U14, K_U15	Design of control systems - basic concepts and characteristics. Feedback system - Reminder . Conventional PID regulator More modern PID .Prescriber Smith . Design limitations for single input and single output systems (ISO) . Limitation of frequency methods. Principle of the internal model. Control with feedback to Forward. Relay control	Zo	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Advanced programming techniques (java or c #)	K_W04, K_W06 K_U02, K_U05, K_U15	1. Interfaces; 2. Virtual methods; 3. Delegates; 4. Anonymous methods; 5. Lambda expressions; 6. LINQ queries; 7. Data Base in programming; 8. Entity Framework; 9. WPF; 10. Exercises; 11. Troubleshooting	Zo	2	Assessment of programming tasks, assessment of teamwork skills.
	Programmable devices	K_W05, K_W08, K_U08, K_U14, K_U15, K_U16	1. Architecture of selected programmable devices. 2. Memory organization. Addressing modes. Interrupts. 3. I/O ports. Timers. A/D converters. PWM. UART. 4. Communication interfaces in programmable devices.5. MicroPython fundamentals. 6. Programmable logic devices. VHDL fundamentals.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Signal Processing	K_W05, K_W08, K_U08	1. Signals in teleinformatics: Determined and Ttrachastic signals. Noise. Signal parameters. Elements of the Information Theory; 2. Transmission modulations. Analog modulations include AM, FM, PM and derived manipulation. PCM and DM digital modulation. Co-ders and Set-Top Box. Decision-making and interpolation. Optimal coding; 3. Primary and advanced DSP algorithms	E	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Monographic Lecture	K_W14	The content of the lecture depends on the topic of the lecture, which the student selects individually.	Z	0,5	essay
Training	Internship "Employee competencies"	K_W15, K_U04, K_U11, K_U19, K_K07	1. Health and safety rules (working with computer, workplace ergonomics); 2. Functioning of an enterprise, company from the IT industry or a company that largely uses IT tools available on the market; 3. Training the skill of combining knowledge gained during previous studies and skills in design, programming, operating systems and the practice of business operations and IT industry institutions; 4. Shaping the model attitudes of the future employee	Z	11	Assessment of the internship book, Assessment of the test on the e-learning platform
	Engineering internship	K_W15, K_U03, K_U04, K_U11, K_U19, K_K07	1. Health and safety rules (working with computer, workplace ergonomics); 2. Ways of planning work and maintaining technical documentation of IT projects; 3. Company's computer system; 4. Computer network in the company; 5. The ability to communicate effectively with other people, time management and the use of available and modern information technologies - preparing the student for the implementation of the diploma engineering thesis; 6. Stimulating student's activity, developing initiative and creativity, preparing student for the implementation of their engineering thesis; 7. Basic concepts in the field of: protection of intellectual property, copyright and industrial property necessary during the implementation of engineering thesis.	Z	21,5	Assessment of the internship book and the implementation of the internship program
Degree awarding process	Engineering Project	K_W07, K_W09, K_U01, K_U02, K_U05, K_U07, K_U12, K_U16, K_U17, K_U18, K_K03	Preparation of an engineering project adapted to the area of studies in the field of computer science nad mechatronics.	Zo	4	Assessment of the engineering project, active participation in the classroom.
	Preparation for the diploma exam	K_W10, K_U18, K_K01	Explaining the issues related to the diploma exam and preparation for a public speech regarding engineering project.	Zo	2	Activity in the classroom, evaluation of the presentation of the engineering project.
	Diploma laboratory/ Diploma workshop	K_W09, K_U01, K_U02, K_U05, K_U07, K_U10, K_U13	1. Implementation of the practical part of the diploma project; 2. Collection of measurement results, conducting experimental tests 3. Preparation of documentation.	Zo	3	Activity in classes, Assessment of the independence of the implementation of tasks, measurements, structures related to the implementation of the engineering project.