

Studies programme part 1

General characteristics of studies	
Main area (specialisation) of the studies:	Department of Informatics and Mechatronics
The area (specialisation) of the studies <i>(the name of the area (specialisation) must be appropriate to the contents of the programme and</i>	AI automation systems design
Level of education: <i>(first and second degree studies, uniform master degree studies)</i>	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:	116
in the course of classes in the humanities or social sciences:	15,5
as part of the training:	32,5
as part of the modules of classes related to practical professional preparation:	168
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: mechanical engineering	43 % of the total number of ECTS credits
discipline (disciplines) : technical computer science and telecommunication	26 % of the total number of ECTS credits
discipline (disciplines) : automatics, electronics and electrical engineering	14 % of the total number of ECTS credits
discipline (disciplines):: other	9 % of the total number of ECTS credits
discipline (disciplines) : materials Engineering	2 % of the total number of ECTS credits
Total student workload	5511
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 <i>(indicate with whom employers the agreements are signed, meetings have taken place; how are the graduates monitored, etc.)</i>	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): **AI automation systems design**

Educational modules with the assumed learning outcomes						
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 protection; 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
Cultures of the world	Cultures 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 relations 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 dynamism. 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 education	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	Definitions of regionalism; regional identity; local identity; historical conditions of regionalist movements; region as the basis of social and cultural identification; social role of regionalists; historical conditions of formation of regional and local cultural heritage; regional and local heritage in creation of local tourist product; strengthening regional identity in the activities of local governments; a selected issue from the history of the formation of Polish regions; regionalism in the cultural policy of the European Union; regionalism as an endogenous potential of the Kuyavia-Pomeranian region; systems of support for endogenous potentials in the context of the 1st Congress of regionalists of Kuyavia and Pomerania	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); 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.
Library Training	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
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 run on 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
	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	The course introduces students to modern, AI-enhanced engineering tools used in data analysis, simulation, and system optimization. Emphasis is placed on practical application in real-world engineering scenarios, with tools and platforms selected by the lecturer based on current industry relevance. Students will gain hands-on experience in using intelligent systems to support design, diagnostics, and decision-making processes.	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 subjects	Basic Engineering Course	K_W09, K_U09	1. Introduction to Arduino ecosystem - Arduino IDE, board configuration and programming, breadboards, jumper wires, shields, Arduino as tool for rapid prototyping. 2. Basic operations - Push-Button Input, Analog Sensor Reading, PWM LED Dimming, Servo Motor Control. 3. Introduction to HMI's - LCDs, keyboards, RFID cards, IR remote control. 4. Serial communication - UART concept, ASCII and UTF coding, data visualization, Node-RED interface. 5. Simple communication interfaces - IIC, pulse width. 6. Introduction to data processing - averaging, time stamps, data integrity, non-volatile memory.	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 laws, 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-ROB; 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.
	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	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. System Modeling 2. Time-Domain Analysis 3. Introduction to Closed-Loop Control Systems 4. Controller Design in the s-Plane 5. Design Techniques in the Frequency Domain 6. Controller Design in the z-Plane 7. Digital Control Systems Design 8. State-Space Methods 9. Optimal Control System Design	Zo	2.5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.

Control Engineering	K_W05, K_U08, K_U14, K_U15	<p>1.Introduction - control system definition, history of control systems, open-loop systems, feedback control.</p> <p>2.Analysis and Design Objectives - transient response, steady-state response, stability.</p> <p>3.Modeling in the frequency domain - Laplace transform, transfer function, block diagrams.</p> <p>4.Time response - zeros, poles, first-order systems, second-order systems, steady-state errors.</p> <p>5.Computer simulation tools - Matlab, Scilab, Python ecosystem.</p> <p>6.Components for automation systems - regulators and controllers, sensors and measurement transducers, drives and actuators, position control (servomechanism).</p>	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	<p>1. Fundamentals of Information Technology</p> <ul style="list-style-type: none"> – Key concepts: information, communication, the information society – AI, Internet and e-learning as pillars of modern IT <p>2. Hardware Considerations</p> <ul style="list-style-type: none"> – External devices and peripherals – Central Processing Unit (CPU) functions – Choosing optimal hardware configurations for specific needs <p>3. Computer Applications</p> <ul style="list-style-type: none"> – Types of computer programs – Standard software packages – Software licensing models <p>4. Computer Networks</p> <ul style="list-style-type: none"> – Network basics and structure – Benefits and risks associated with internet use <p>5. E-Learning: Content and Tools</p> <ul style="list-style-type: none"> – Digital learning platforms – Practical use of e-learning environments <p>6. Practical Skills Development</p> <ul style="list-style-type: none"> – Creating and formatting text documents – Conducting basic data analysis and visualizing results in graph form – Designing multimedia presentations for academic and project-based work 	Z	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Strength of Materials	K_W03, K_W09, K_U02, K_U16, K_U02	<p>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</p>	E/Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Metrology	K_W01, K_W05, K_U08, K_U15	<p>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.</p>	Zo	2	Activity in laboratory classes, passing individual laboratory exercises.
Computer Networks	K_W04, K_W06, K_W09, K_U02, K_U05, K_U14	<p>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.</p>	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	<p>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; 12. Functions; 13. Files and streaming</p>	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	<p>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</p>	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
Computer Systems Architecture	K_W06, K_U16	<p>1. Essence of Computer Systems Organization & Architecture</p> <ul style="list-style-type: none"> - Brief history and evolution of computers <p>2. Levels of Virtual Machines</p> <p>3. Von Neumann Architecture</p> <p>4. Generations of Computer Technology</p> <p>5. Complement Number Systems</p> <p>6. Floating-Point Numbers</p> <p>7. IEEE-754 Standard</p> <p>8. Binary Coding Schemes</p> <p>9. Representation of Numbers</p> <p>10. Data Structures: Arrays & Records</p> <p>11. Simple Computer Organization</p> <ul style="list-style-type: none"> - Data format - Instruction format <p>12. Instruction Fetch Cycle</p> <p>13. Instruction Execution & Instruction Set</p> <p>14. Addressing Modes</p> <ul style="list-style-type: none"> - Immediate, direct, indirect, indexed, etc. <p>15. Address Calculations & Assembly Process</p> <p>16. Memory System Organization</p> <ul style="list-style-type: none"> - SRAM vs. DRAM - LIFO/FIFO buffers <p>17. Cache & Stack Memories</p> <p>18. EPROM Technologies</p> <p>19. Input/Output System Organization</p> <ul style="list-style-type: none"> - System bus: address bus, data bus, control bus - Bus structure <p>20. Synchronous & Asynchronous Data Transmissions</p> <p>21. Tri-State Bus Drivers</p> <p>22. Arithmetic & Logic Unit (ALU)</p> <p>23. Control Unit</p> <p>24. Simple Microprocessor (CPU) Organization</p> <p>25. Instruction Set Architecture (ISA)</p> <ul style="list-style-type: none"> - CFI and CII rules 	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	<p>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</p>	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	<p>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</p>	Zo	4,5	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	<p>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 RIPv2 timers. Protocol limitations for discontinuous networks. Propagate default route in the RIPv2 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.</p>	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	<p>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 chips; 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.</p>	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
PHP Programming	K_W04, K_W06 K_U02, K_U05, K_U15	<p>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.</p>	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	<p>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, semantic 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, B+ tree family data structures, 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</p>	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
Rapid Prototyping (3D Printing)	K_W02, K_W03, K_W07, K_U15	<p>1.Introduction and Safety Best Practices - overview technologies, workshop safety (ventilation, PPE, handling resins and filaments), 3D printer construction and basic maintenance routines, unboxing and hardware setup, Firmware basics and control interfaces.</p> <p>2. Initial printer calibration - mechanical checks, endstop adjustment.</p> <p>3. Bed Leveling and First Layer Perfection - manual vs. automatic (BLTouch, inductive) leveling workflows, live Z-adjustment techniques, troubleshooting first-layer adhesion (tape, glue stick, PEI sheets).</p> <p>4.Slicing Fundamentals - installing and configuring a slicer, key settings: layer height, infill, wall thickness, print speed, support structures, exporting G-code.</p> <p>5.Filament and Resin Materials - PLA, ABS, PETG, TPU, carbon-fiber blends, flexible, nylon, resin types: standard, tough, dental, castable—and resin handling.</p> <p>6.Printouts: Monitoring and Troubleshooting - common defects: stringing, warping, under-extrusion, layer shifts, real-time monitoring.</p> <p>7.Post-Processing Techniques - support removal and surface finishing (sanding, filing), chemical smoothing (acetone vapor, resin washes), painting, priming, and assembly.</p> <p>8.3D Projects Repositories.</p>	Zo	5,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.

Module A

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; 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 LOGO18 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	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Robotics	K_W08_K_U02	1. Open-Loop Robot Kinematics: <ul style="list-style-type: none">- Differential drive principles and kinematic equations- Executing basic maneuvers- Timing control and motion sequencing 2. Line-Following Implementation: <ul style="list-style-type: none">- Interfacing and calibrating downward-facing line sensors- Signal processing: thresholding and noise filtering- Control strategies for reliable line tracking 3. Closed-Loop Motion Control: <ul style="list-style-type: none">- Encoder fundamentals: types and interfacing techniques- PID control loops for velocity and position regulation- Performance tuning and stability analysis 4. Proximity Sensing and Distance Measurement: <ul style="list-style-type: none">- Reading bump switches and optical distance sensors- Ultrasonic sensor integration and signal interpretation- Sensor fusion basics for enhanced reliability 5. Obstacle Avoidance and Line Following: <ul style="list-style-type: none">- Reactive navigation algorithms- Line-following strategies- Collision prevention and safe path planning 6. Maze Exploration and Mapping: <ul style="list-style-type: none">- Maze-solving algorithms: flood-fill, Tremaux's algorithm- Autonomous exploration and map building- Shortest-path computation and return-to-start routines 7. Inertial Navigation Systems <ul style="list-style-type: none">- Accelerometer and gyroscope interfacing and calibration- Dead-reckoning: velocity and position estimation from IMU data- Drift mitigation techniques 8. GPS-Based Outdoor Navigation <ul style="list-style-type: none">- GPS module integration and NMEA sentence parsing- Waypoint navigation and geofencing- RTK basics for enhanced positional accuracy	Zo	4	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Elements of Mechanical Design	K_W02_K_W03_K_W07_K_W09_K_U02_K_U16_K_K02	1. Basic principles of the design process. 2. Elements of the mechanism, characteristics of load types, defining loads and formulating appropriate strength conditions. 3. Connections and their calculation: soldered, welded, glued, riveted, shaped: wedge, pin. 4. Threaded connections. 5. Screw mechanisms: examples and application. 6. Clutches and brakes. 7. CAD (computer-aided design). 8. Design process on selected examples	Zo	2	Assessment of individual tasks
Energy Harvesting	K_W05_K_U08	1. Fundamentals of Energy Harvesting <ul style="list-style-type: none">- Power vs. Energy: key definitions, units, and system requirements- Transduction Mechanisms:<ul style="list-style-type: none">- Piezoelectric generators (vibration-to-electric conversion)- Thermoelectric generators (Seebeck effect)- Photovoltaic cells (solar energy conversion)- Fuel cells (chemical-to-electrical conversion)- Power Management Circuits: MPPT techniques, voltage regulation, energy conditioning 2. Energy Storage Technologies <ul style="list-style-type: none">- Battery Fundamentals: capacity, energy density, power density, life-cycle metrics- Battery Chemistries & Specs: lead-acid, NiMH, Li-ion, LiFePO₄, emerging solid-state- Charging & Management: charge algorithms (CC/CV, pulse), BMS functions, safety considerations- Alternative Storage: ultracapacitors (supercaps) and hybrid storage architectures- Modeling & Simulation: electrical equivalent circuits, state-of-charge estimation, simulation tools 3. Application Case Studies <ul style="list-style-type: none">- Wireless Sensor Networks: self-powered environmental and infrastructure monitoring nodes- RFID and Passive ID Tags: harvesting ambient RF for tag operation- Battery-Free Switches and Interfaces: kinetic-powered home automation controls- Medical Implants and Wearables: thermoelectric and kinetic energy for continuous operation- Smart Textiles: integrating flexible solar cells and piezo materials into garments for wearable power generation	Zo	2	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
Python Programming	K_W04_K_W06_K_U02_K_U05_K_U15	1. Python Foundations - Python syntax, virtual environments, variables, data types, data structures, control flow, loops, functions, modules. 2. Object-Oriented Programming - defining classes, constructors and initializers, dunder methods, class variables, encapsulation, inheritance, polymorphism. 3. Data Verification and Validation - validating user input (type/check ranges), asserts, exceptions, data validation libraries. 4. Working With Files in Python - text files, CSVs with the built-in csv module and with Pandas, JSON and YAML, binary files, working with PDFs, resource management and exception handling in file operations. 5. Data Visualization & Plots - matplotlib, Seaborn, Bokeh, saving figures to files interactive plots with plotly. 6. Building a GUI - windows and widgets basics, layout managers, event binding and callbacks, menus, dialogs, canvases drawing, working with dashboard libraries. 7. Web APIs with FastAPI - setting up FastAPI and Uvicorn, defining routes, request/response models, dependency injections and middleware, automatic docs, deployment.	Zo	3	Assessment of individual tasks
Numerical Methods	K_W04_K_W06_K_U09	1. Root And Extrema Finding - Bisection Method, Secant Method, Golden Ratio Search, Newton-Raphson Method, Gradient Descent 2. Solving Systems of Linear Equations 3. Numerical integration - Trapezoidal Rule, Simpson's Rule, Midpoint Rule 4. Numerical Differentiation - Forward difference, Backward difference, Central difference, Taylor series 5. Matrices - Eigenvalues and Eigenvectors, Power Method, QR Method, Eigenvalue Decomposition (EVD), Singular Value Decomposition (SVD) 6. Interpolation - Linear Interpolation, Cubic Spline Interpolation, Lagrange Polynomial Interpolation, Newton's Polynomial Interpolation 7. Least Squares Regression 8. Methods to Numerically Solve Ordinary Differential Equations 9. Hardware Implementation of Selected Algorithms	Zo	2	Final test, active Activity in laboratory classes. Assessment of the performance of individual programming tasks
Electrical Machines	K_W05_K_W08_K_U13_K_U15_K_U16	1. Fundamentals of Electric Machine Design: <ul style="list-style-type: none">- Overview of machine types & applications.- Thermal, mechanical, and electrical design constraints.- Standards, materials, and manufacturing considerations. 2. Magnetic Circuit Design: <ul style="list-style-type: none">- Magnetic flux paths and reluctance modeling.- Core material selection and loss minimization.- Air-gap sizing and fringing effects. 3. Transformer Design Principles: <ul style="list-style-type: none">- Core geometry and winding configurations.- Insulation systems and thermal performance.- Short-circuit withstand and efficiency optimization. 4. Three-Phase Induction Motor Design: <ul style="list-style-type: none">- Equivalent circuit analysis and performance targets.- Stator & rotor slot design, winding selection.- Torque-speed characteristics and thermal limits. 5. Single-Phase Induction Motor Design: <ul style="list-style-type: none">- Starting methods and auxiliary winding design.- Capacitor sizing for phase-shift control.- Performance evaluation and applications. 6. Synchronous Machine Design: <ul style="list-style-type: none">- Rotor excitation methods (salient-pole vs. cylindrical).- Air-gap field distribution and armature winding layout.- Stability, synchronizing torque, and voltage regulation. 7. DC Machine Design: <ul style="list-style-type: none">- Armature winding types and commutation strategies.- Field winding configurations and brushgear design.- Thermal management and performance optimization.	Zo	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Elective Subject : Fundamentals of Machine Operation	K_W03_K_W09_K_U02_K_U16_K_K02	1. Production and technological process. 2. Modern trends in machine technology. 3. Structure and documentation of the technological process. 4. General principles of designing technological processes. 5. Selection of technological machines. 6. Production costs. 7. Manufacturability of the structure. 8. Typical mechanical machining operations: turning, milling, drilling, grinding 9. CNC machines 10. Design of technological processes of typical machine parts. 11. CAD/CAM software for design and production.	Zo	2	Assessment of individual tasks

Elective Subject : Fundamentals of Machine Components Design	K_W03, K_W09, K_U02, K_U16, K_K02	1. Design in mechanical and mechatronic engineering in modern production processes. 2. Work, energy and power in machine design. 3. Types of loads, Stresses and strains. 4. Strength properties of materials. 5. The process of selecting engineering materials. 6. Damage theories and safety factors. 7. Fatigue life. 8. Surface damage. 9. Laboratory tests in the area of machine design.	Zo	2	Assessment of individual tasks
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
Operating Systems	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	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
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
Engineering Materials: Structure, Properties and Selection	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
Electric Drives	K_W05, K_W08, K_U13, K_U15, K_U16	1.Introduction to Electric Drives - overview of drive types and applications, basic drive system architecture 2.DC Drive Systems - DC motor construction and characteristics, armature and field control methods, speed control via armature voltage, chopper circuits and control 3.AC Induction Motor Drives - induction motor equivalent circuit and performance, U/f control 4.Inverter Drives - PWM techniques (SPWM, SVPWM), harmonics and filtering 5.Sensorless and Vector Control - field-oriented control (FOC) principles, sensorless rotor flux estimation. 6.Permanent Magnet Synchronous Motor (PMSM) Drives - PMSM characteristics and modeling, control strategies (FOC, DTG). 7.Stepper motors and drives. 8.Switched reluctance motors 9.Drive Protection and Diagnostics - overcurrent, overvoltage, and thermal protection, fault detection and fault-tolerant control.	Zo	3,5	Tasks done during laboratory classes; Attendance; Final project
Artificial Intelligence Tools	K_W04, K_W06, K_U08, K_U09	1.Tool to run LLMs locally. 2.Tools to build AI virtual assistants and AI agents. 3.Using no-code and low-code tools to create AI-powered systems. 4.Generating programming code with AI assistance. 5.Preparing and managing technical documentation supported by AI. 6.Hardware and software solutions for AIoT	Zo	Zo	Assessment of individual tasks
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.
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 structures, 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.
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.
Artificial Intelligence	K_W04, K_U09	1.Introduction to AI - History and Evolution of AI, Types of AI, Basic Definitions, Decision trees, Fuzzy systems, Genetic algorithms, Bayesian networks, Real-World Applications of AI. 2.Setting up Dev Environment - Installing Python and AI Libraries, Introduction to Jupyter Notebooks, Google Colab. 3.Introduction to Machine Learning - Types of Machine Learning: Supervised, Unsupervised, Reinforcement Learning, Introduction to Data Preprocessing, Building Simple Machine Learning Model. 4.Deep Learning - Introduction to Neural Networks, Building and Training a Simple Neural Network. 5.Natural Language Processing - Introduction to NLP and Text Processing, Text Preprocessing: Tokenization, Lemmatization, and Stop Words, Language Models, Tools and Implementation.	E	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Embedded Systems	K_W04, K_W05, K_W09, K_U02, K_U14, K_U16	1.Introduction to MicroPython - Raspberry Pi Pico W hardware architecture, setting up the development environment, connecting and powering the Pico board. 2.MicroPython Fundamentals - key differences between Python and MicroPython, scripts, and modules on the Pico W, data types, control flow, and functions in MicroPython 3.GPIO and Peripheral Interfacing - digital inputs and outputs, analog inputs, PWM outputs. 4.Communications interfaces - communicating with external devices using IIC, SPI, UART. 5.Networking and Wireless Connectivity - Wi-Fi setup on the Pico W, making HTTP requests and serving simple web pages, MQTT protocol. 6.Real-Time Operations and Power Management - timers and interrupts in MicroPython, scheduling tasks and implementing non-blocking code, low-power modes and battery management strategies, watchdog timer usage for fault resilience. 7.Data Logging and Storage - storing data on the onboard filesystem and external SD cards, formatting and parsing CSV and JSON logs, timekeeping and timestamping sensor data, transmitting logged data to cloud services and Node-RED servers.	Zo	3	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 Photoshop 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	2,5	Activity in laboratory classes, passing individual laboratory exercises. Project evaluation.
Programmable Logic Controllers	K_W05, K_W08, K_U08, K_U14, K_U15, K_U16	1.Architecture and operating principle of PLCs: PLC block diagram, operating modes, PLC operating cycle and specific times, memory map. 2.Connecting PLC to plants: power supply considerations, types of PLC inputs, types of PLC outputs, PLC inputs and outputs technical and performance specifications, communication interfaces 3.Ladder Diagram (LD) for Omron Devices - rungs, reading memory, writing memory, timers, counters, data transfer operations, data comparison, subprograms, binary and BCD calculations, data conversion. 4.Design and operation of programmable relays - concept of programmable relay, PLC and programmable relay comparison; FBD language. 5.HMI - creating user interfaces.	E	2	Written exam. Evaluation of the laboratory exercises. Assessment of work in a group.
Artificial Intelligence of Things	K_W04, K_W06, K_U02, K_U14, K_U15	1.Introduction to IIoT: definition of IIoT, Industry 4.0 and Industrial Internet of Things, Internet of Medical Devices (IoMT), design rules for IIoT systems and devices, security in IIoT systems, ethics and law in Internet of Things world. 2.Communication interface for IIoT: 802.11 based solutions, LoRa, LoRaWAN, Sigfox, GLoWPAN, NB-IoT. 3.IIoT 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 - air quality, environmental measurement systems, PV monitoring system, health monitoring system. 6.Edge AI Inference on Embedded Devices - deploying lightweight neural networks (eg. TensorFlow Lite, MicroML) on microcontrollers, model quantization and pruning to fit resource-constrained hardware.	Zo	2,5	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Machine Learning	K_W04, K_W05, K_W06, K_U09	1. Machine Learning Foundations - supervised and unsupervised learning, model evaluation, Python ecosystem, regression, classification, clustering. 2.Core Classification Algorithms - logistic regression, naive Bayes, k-nearest neighbors, SVMs, decision trees. 3.Deep Learning Architectures - CNNs for vision, RNNs/LSTMs for sequential data, transformer basics, fine-tuning pre-trained models. 4. TinyML on Microcontrollers - hardware platforms, classifiers implementation. 5. Introduction to object detection on Raspberry Pi.	Zo	2	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 asynchronous 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
AI Systems Design	K_W04, K_W06, K_U09, K_U16	1. Overview of the Language Model Ecosystem - Licenses and access methods - Paid vs. free models - Service-based vs. locally-run models - Selection criteria: cost, privacy, performance, scalability - Concepts: token, SLM, hallucinations 2. Runtime Environments for Large and Small Language Models 3. Retrieval-Augmented Generation Architecture: - Principles of data flow - Types of RAG - Data preparation - Building a vector database - Integration with the LLM - Optimization of the retrieval stage - Enterprise system integration - Libraries and programming tools for RAG implementation 4. MCP Protocol Architecture and Specification: - Discussion of components - Message structure - Context modeling and serialization - Transport layer implementation - Integration with large language models - Integration with web services - Libraries and programming tools for implementation 5. Building Advanced AI Agents	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Building Automation Systems	K_W05, K_W06, K_W08, K_U02, K_U05, K_U16	1. Communication protocols in building automation systems. 2. Tools and products used in building automation. 3. An overview of different building automation ecosystems 4. Designing a building automation implementation 5. AI and smart solutions in building automation.	Zo	3	Assessment of individual tasks, Project evaluation.
AI-based Applications	K_W04, K_W06, K_U08, K_U09	1. Integration with LLM APIs: communicating with models via REST API (ChatGPT, Azure OpenAI); authorization, sending prompts, processing responses. 2. Using LLMs in web applications: integration with PHP/Laravel backend; passing user data, interpreting model output. 3. Creating custom LLM-based APIs: building a middleware layer (API proxy) to control model behavior and filter data. 4. Local models: running and managing LLMs on your own server (e.g., Ollama, LM Studio); communication interfaces, limitations, and use cases. 5. Practical scenarios: content generation, summarization, classification, chatbots, form and messaging automation. 6. Project: building a web application that integrates a local or cloud LLM with the backend, evaluating performance and costs.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
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/VR 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
	Components and Devices of Control Systems	K_W05, K_W08, K_U08, K_U14, K_U15	1. Overview of Control System Architecture - Functional block diagrams, Signal flow and system requirements 2. Sensors and Transducers - position, velocity, pressure, temperature sensors, signal conditioning: amplification, filtering. 3. Actuators and Drives - electric motors (DC, stepper, servo), hydraulic and pneumatic actuators, drive electronics basics. 5. Signal Conversion and Interfaces - ADCs and DACs: architectures and performance, isolation amplifiers, multiplexers. 6. Control System Buses and Networking. 7. Power Supplies and Protection - DC/AC power modules, UPS systems, surge protection, circuit breakers, EMC practices. 8. Human-Machine Interfaces (HMI) - keypads, touchscreens, industrial displays, dashboards. 9. Control panel layout, grounding, and cable selection. Safety standards and labeling.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Data Transmission	K_W04, K_W05, K_U16	1. High-Speed Parallel Communication 2. Universal Serial Data Transfer over USB 3. IIC-Based Serial Data Coupling 4. I/AG Interface and TAP Controller Architecture 5. RFID Systems for Radio-Frequency Identification 6. POWERLINK Real-Time Industrial Ethernet 7. TCP/IP Networking for Remote Measurement & Control 8. Smart Card Read/Write Technologies 9. EMI/RFI Mitigation and Signal Integrity Techniques 10. Modbus RTU over RS-485 Physical Layer 11. Fiber-Optic Communication Links 12. Infrared (IR) Wireless Data Transmission	E	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. Raspberry Pi Architecture and Python Setup - installing Raspberry Pi OS, enabling SSH, Python 3 environment, basic Git workflow. 2. Data Acquisition and Plotting - reading analog signals, using interface (IIC, SPI) and USB DAQ devices, sampling rates, calibration, and noise filtering, real-time plotting with Matplotlib and live dashboards. 3. Computer Vision - connecting and configuring the Pi Camera module and USB camera, capturing frames in Python (picamera / opencv-python), simple vision tasks: motion detection, color tracking. 4. Human-Machine Interface Design - building touchscreen GUIs with Tkinter or Kivy, web-based interfaces using Flask or Dash, displaying real-time plots and controls on HMI. 5. Communication Protocols and Network Operations - Python libraries for IIC, SPI, UART, USB; Ethernet/Wi-Fi setup, socket programming, MQTT messaging, secure network operations. 7. Threading and asynchronous operations.	Zo	2	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
	Signal Processing	K_W05, K_W08, K_U08	1. Fundamentals of Signals: - Deterministic vs. stochastic signal models - Noise characterization and signal-to-noise ratio - Key signal parameters: bandwidth, power, energy, information content - Introductory concepts from Information Theory: entropy, mutual information 2. Modulation & Coding Techniques: - Analog Modulation: AM, FM, PM and their derivatives (e.g., SSB, VSB) - Digital Modulation: PCM, B-modulation, ASK, FSK, PSK, QAM - Source and channel coding principles: optimal coding theorems, error-correcting codes - Set-top box architectures: signal decoding, decision algorithms, interpolation methods 3. Digital Signal Processing Algorithms: - Core DSP building blocks: filtering, convolution, FFT - Adaptive filtering and noise cancellation techniques - Multirate processing: decimation, interpolation, polyphase structures - Advanced algorithms: spectral analysis, wavelet transforms, and real-time DSP implementations	E	3	Activity in laboratory classes, passing individual laboratory exercises. Assessment of reports.
Training	Monographic Lecture	K_W14	The content of the lecture depends on the topic of the lecture, which the student selects individually.	Z	0,5	Project
	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
	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 informatics 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.
Degree awarding process	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.