

Program studiów cz.1

Ogólna charakterystyka studiów	
Prowadzący obszar (specjalność) studiów:	Instytut Informatyki i Mechatroniki
Obszar (specjalność) studiów <i>(nazwa obszaru (specjalności) musi być adekwatna do zawartości programu studiów a zwłaszcza do</i>	Computer engineering and mechatronics
Poziom kształcenia: <i>(studia pierwszego, drugiego stopnia, jednolite studia magisterskie)</i>	studia pierwszego stopnia
Profil kształcenia:	praktyczny
Forma studiów:	stacjonarna
Liczba semestrów:	7
Praktyki (łącznie wymiar):	960 godzin w terminie do 7 semestru łącznie
Szkolenie BHP w wymiarze:	8 godzin na początku 1 semestru, realizowane w ramach modułu Bezpieczeństwo i ergonomia pracy
Liczba punktów ECTS konieczna do uzyskania kwalifikacji odpowiadających poziomowi studiów	210
Łączna liczba punktów ECTS uzyskanych:	
prowadzących zajęcia:	179
w ramach zajęć z dziedziny nauk humanistycznych lub społecznych:	13,5
w ramach praktyk:	30
w ramach modułów zajęć związanych z praktycznym przygotowaniem zawodowym:	195
za zajęcia realizowane w systemie zdalnym (dotyczy studiów w systemie zdalnym):	
<i>(dotyczy kierunku przyporządkowanego do więcej niż jednej dyscypliny):</i>	
dyscyplina wiodąca: automatyka, elektronika i elektrotechnika	63% - 63% ogólnej liczby punktów ECTS
dyscyplina (dyscypliny): informatyka techniczna i telekomunikacja	21% - 21% ogólnej liczby punktów ECTS
dyscyplina (dyscypliny): inżynieria mechaniczna	16% - 16% ogólnej liczby punktów ECTS
Łączny nakład pracy studenta (NPS)	5546
Tytuł zawodowy uzyskiwany przez absolwenta:	inżynier
Wskazanie, czy w procesie definiowania efektów uczenia się oraz w procesie przygotowania i udoskonalania programu studiów uwzględniono opinie interesariuszy <i>(należy podać z kim z pracodawców są podpisane umowy, odbyły się spotkania; jak są monitorowani absolwenci itd)</i>	Umowy podpisane: Innovlabs sp z o.o.; Logon SA; Spotkania odbyły się z: Innovlabs sp z o.o.; Logon SA; Asseco Poland S.A. oddział w Bydgoszczy. Losy absolwentów na podstawie kontaktów własnych
Wymagania wstępne <i>(oczekiwane kompetencje kandydata – zwłaszcza w przypadku studiów drugiego stopnia)</i>	Znajomość języka angielskiego na poziomie B2
Relacja obszar (specjalność) - kierunek	Mechatronika

Program studiów cz.2

Obszar (specjalność): Computer engineering and mechatronics

Moduły kształcenia wraz z zakładanymi efektami uczenia się						
Moduły kształcenia	Przedmioty	Zakładane efekty uczenia się	Treści programowe zapewniające uzyskanie efektów uczenia się	Wygor	Liczba	Sposoby weryfikacji zakładanych efektów
Przedmioty kanoniczne						
Wybrane zagadnienia z ekonomii i przedsiębiorczości	Selected issues of economics and entrepreneurship	K_W14, 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	1,5	Test na platformie zdalnego nauczania, prace pisemne, ocena nauczycielska, koleżeńska
Bezpieczeństwo i ergonomia pracy	Health and safety	K_W17, 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	Testy na platformie zdalnego nauczania
Podstawy prawa i ochrona własności intelektualnej	Fundamentals of law and the protection of intellectual property	K_W13, 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	Test na platformie zdalnego nauczania
Nowoczesne technologie	Basics of distance learning	K_W12, 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	Testy, ankiety, dyskusja na forum
Kluczowe kompetencje społeczne	Key social competence	K_K01, K_K03, K_K05,	Social relations; Assertiveness; Coping with stress; Savoir vivre in interpersonal communication and self-presentation; Interpersonal communication; Interpersonal communication techniques; Intercultural communication; Self-presentation; Presentation techniques; Public speaking; Time management; Negotiations	Z	2	Praca indywidualna i grupowa na zajęciach; wypowiedzi ustne; testy na platformie ONTE
	Intercultural integration	K_K05, K_K07,	Definition of culture; Definition of the following terms: society, economy, globalization, religion, customs, etc.; Polish and European culture against the background of cultures of other countries and continents; Functioning of academic culture;	Z	0,5	Prezentacja multimedialna na zadany temat
Język obcy	Foreign Language	K_U06, K_U17, K_U19,	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	praca pisemna Test gramatyczny; test leksykalny; wypowiedź ustna; udział w dyskusji; odgrywanie ról; zadania na zrozumienie tekstu pisanego; zadania na zrozumienie tekstu słuchanego; wykonanie zadań w modułach językowych na platformie edukacyjnej
	Specialist foreign language	K_U06, K_U17, K_U19,	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	Praca pisemna; wypowiedź ustna; zadania na zrozumienie tekstu technicznego pisanego; zadania na zrozumienie tekstu technicznego słuchanego.
Kultura fizyczna	Physical Education	K_U21,	Team games; General development classes with elements of basketball, volleyball, handball, football, floorball; Fitness	Z	0	Test; samoocena, analiza, obserwacja
Filozofia praktyczna	Ethics	K_W15, 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	0,5	Praca zaliczeniowa – esej; kolokwium
Elastyczne kształcenie	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	Test na platformie zdalnego nauczania
	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	Test na platformie zdalnego nauczania
	Pre-Medical First Aid	K_U21	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; zadania; obserwacja pracy studentów podczas realizacji ćwiczeń, ocena oraz analiza wykonanych zadań praktycznych
	Specialist IT systems	K_U14, K_W06,	1. Working with Microsoft 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	Aktywność na zajęciach laboratoryjnych, zaliczenie poszczególnych ćwiczeń laboratoryjnych. Test na platformie zdalnego nauczania.

	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	Pisemne testy kontrolne, ustne odpowiedzi sprawdzające znajomość gramatyki i słownictwa; pisemne wypowiedzi w ramach zadań domowych, pracy na zajęciach; krótkie wypowiedzi pisemne; praca domowa, praca na zajęciach, pisemne testy kontrolne sprawdzające umiejętność czytania ze zrozumieniem; samoocena, obserwacja; ocena aktywności i zaangażowania na zajęciach, obserwacja pracy w parach lub grupach
Przedmioty podstawowe	Basic Engineering Course	K_W11, K_U09, K_U16	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	5	Zaliczenie ćwiczeń wykonywanych w ramach laboratorium, ocena aktywności na zajęciach.
	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.	Zo	3	Ocena wykonania ćwiczeń laboratoryjnych.
	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	ocena wykonania ćwiczeń laboratoryjnych.
	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	Zo	7,5	Ocena aktywności na ćwiczeniach, Ocena wykonania zadań reprezentujących poszczególne działy tematyczne
	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	Ocena aktywności na zajęciach, Ocena wykonania ćwiczeń laboratoryjnych. Ocena sprawozdań.
	Strength of materials	K_W02, K_W09, K_U11, K_U15,	Durability, strength and resistance of materials. Constitution and structure of materials, elasto-plastic and brittle materials, physical and mechanical properties of solid states, properties dependence on the structure and the physical state of the materials, physical quantities and the units of measurements, materials characterization, standardized parameters, methods of materials investigation, rules and principles as referred to rigid body and continuum, types of loads. Passive and active forces, surface and body forces, internal forces, loads, stresses, strains, quasi-equilibrium static and dynamic processes, homogeneity and anisotropy. Stress and strain tensors, fundamentals of theory of elasticity, stress-strain diagram at uniaxial loading, hysteresis of deformation, strength parameters, temperature characteristics of the strength parameters variations, dependence of strain-stress relationship on the rate of deformation, yield point for plastic deformation, tensile strength, impact strength, toughness, hardness, fatigue strength, shear, bending-stress and strain state, deflection line, torsion, stresses within the bar during torsion, fracture, fatigue process, degradation and wear processes, fundamentals of fracture mechanics, the Griffith theory, environmental interactions and loadings, temperature and radiation influences, resistance of various materials to damage, materials performance under various loadings of various intensity.	Zo	2,5	Ocena wykonania ćwiczeń laboratoryjnych.
	Control Engineering	K_W05, K_W08, K_U08, K_U14 ,	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	Kołokwium zaliczeniowe, aktywność na zajęciach. Ocena sprawozdań z laboratorium
Przedmioty kierunkowe i obszarowe						
	IT Technologies	K_W04, K_U07,	Document editing rules, document formatting rules, working with tables, creating tables of contents. Rules for entering and editing data in a spreadsheet, creating formulas, basic functions of data aggregation, pivot tables, charts. Rules for creating presentations, adding animation effects, preparing presentations. 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	2	Ocena wykonania ćwiczeń laboratoryjnych.
	Expert classes	K_W16, K_U15,	The content of the lecture depends on the topic of the lecture, which the student selects individually.	Zo	2	Ocena wykonania ćwiczeń laboratoryjnych.
	Computer networks	K_W04, K_W06, K_W10, K_W11, 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	4	Ocena wykonania ćwiczeń laboratoryjnych. Ocena aktywności na zajęciach.

Programming	K_W04, K_W06, K_W10, 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	4	Kolokwium zaliczeniowe, aktywność na zajęciach. Ocena wykonania poszczególnych zadań programistycznych
Computer Aided Design	K_W06, 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	3	Ocena opanowania narzędzi graficznych dostępnych w oprogramowaniu CAD. Ocena projektu końcowego.
Computer systems architecture	K_W06, K_U16,	1. the essence of computer systems organization and architecture: short of computer evolution and history; 2. level of virtual computers; 3. structure of von Neumann computer (IAS); 4. generations of computer technology; 5. complement 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, assembling); 16. organization of memory systems ((S/D)RAM, LIFO/FIFO; 17. cache and stack memories; 18. (EPROM); 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	Ocena wykonania ćwiczeń laboratoryjnych.
Object-Oriented Programming	K_W04, K_W06, K_W10, 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	Ocena aktywności na zajęciach. Ocena wykonania poszczególnych zadań programistycznych
Advanced Computer Aided Design	K_W06, 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	Ocena wykonania zadań w ramach laboratorium. Ocena projektu końcowego.
Advanced Computer Networks	K_W04, K_W06, K_W10, K_W11, 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 discontinuous 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	2	Ocena aktywności na zajęciach. Ocena wykonania poszczególnych zadań programistycznych
Digital Circuits	K_W05, K_W08, K_U15,	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	3	Ocena wykonania zadań w ramach laboratorium.
Network devices	K_W04, K_W06, K_W10, K_U02,	1. Working with modern network devices: Building a router and a switch; Operating System (e.g., IOS); The command line and basic router and switch instructions; 2. Routing: Configure static routing; Types of dynamic routing protocols; Configure selected dynamic routing protocols (RIP, EIGRP, OSPF); Backup routes; Routing optimization; 3. Switching: Packet switching concept - CAM table; Concept of Virtual LANs (VLANs); Trunking and inter-VLAN routing; Spanning tree Protocol 4. Wireless Networks: Radio Protocols; Wireless Security; Wireless Access Point Configuration 5. Additional Network Device Services: DHCP Server; IP Address Translation (NAT); Network Traffic Filtering (ACL).	E	3,5	Ocena aktywności na zajęciach. Ocena wykonania poszczególnych zadań programistycznych
PHP Programming	K_W04, K_W06, K_W10, K_U02, K_U05,	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	3	Ocena aktywności na zajęciach. Ocena wykonania poszczególnych zadań programistycznych
Databases	K_W04, K_W10, 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	Ocena z ćwiczeń laboratoryjnych w zakresie projektowania, budowy baz danych.

Moduł A: Przedmioty kierunkowe

Modern Power Supply Systems	K_W05, K_W08, K_U16, K_U17, K_U18,	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	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach i umiejętności pracy w grupie
Computer Measurements Systems	K_W01, 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	Ocena wykonania ćwiczeń laboratoryjnych
Project Management	K_W17, 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	Ocena aktywności na zajęciach, Ocena wykonania ćwiczeń.
Engineering Project	K_W03, K_W05, K_W06, K_W07, K_W08, K_W09, K_W11, K_W12, K_U01, K_U02, K_U05, K_U06, K_U10, K_U12, K_U13, K_U17, K_U16, K_U18, K_K04, K_K07	Preparation of an engineering project adapted to the area of studies in the field of computer science.	Zo	9	Ocena projektu inżynierskiego, aktywność na zajęciach
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	Ocena wykonania ćwiczeń laboratoryjnych
Elements of Mechanical Design	K_W02, K_W03, K_W07, K_W09, K_U02	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;	E	2	Egzamin pisemny, Ocena aktywności na zajęciach, Ocena wykonania ćwiczeń.
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	3	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach.
Internet of things	K_W04, K_W06, K_U02, K_U14, K_U16,	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 – air quality, environmental measurement systems, PV monitoring system, health monitoring system.	E	3	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach.
User Interface Design	K_U16, K_U07,	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	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach, ocena wykonania projektu końcowego
Digital Signal Processing	K_W05, K_W08, K_U08,	1. Digital filtration; 2. Correlation analysis and matched filtration; 3. Frequency signal processing - DFT, DCT, DST; 4. Time-frequency processing - Transforms: 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	3,5	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach.
Analog Circuits	K_W05, K_W08, K_U15,	1. The passive components RLC. RC and CR frequency characteristics. Semiconductors - self-existence and insolent. Bipolar transit. Polarisation systems of a bipolar transistor. Small Signal Replacement Diagrams. EC, WB, WC Amplifiers. Current sources. 4.Unipolar transients JFET and MOSFET: Principle of operation, basic parameters and static characteristics. Polarisation systems of unipolar transistor. WS, WG, and WD Amplifiers. Field Transistors Applications 5.Optoelectronics instruments: LED, Photo Resistor, Photodiode, Phototransistor, Tranoptor. Sensors for non-electrical quantities such as temperature, force, acceleration, etc. 6.Tires, triacs. Basic electrical systems 7.elementary feedback theory. The effect of negative feedback on the gain strength and frequency response of the amplifier. Amplifier stability. Power amplifiers: Class division, efficiency, distortion.9. Integrated operational amplifier: An ideal amplifier and a real amplifier. Operating amplifier basic operating systems: Reversing amplifier, non-conducting amplifier, totalization, subtraction, integration circuit, differential unit, first row low-pass filter, PI, PD, PID, voltage controlled current source. Analogue Comparators. Measuring amplifiers.10.Rectangular and triangular run generator. LC and RC sinusoidal generators, generation conditions.11. Compensating stabilisers - operating principle. Converters and pulse stabilisers - operation	Zo	3	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach.

Measurement systems	K_U15, K_W01, K_W05, K_U08	1. Basic metrology - size and measurement, units, basic concepts; 2. Measurement systems - accuracy, error and measurement uncertainty; 3. Propagation of measurement uncertainty; 4. Measurement methods - classification and description; 5. Acquire and process signals. Measurement of electrical and mechanical size; 6. Coordinates metrology - selection of measuring instruments; 7. Optical measurement of geometrical quantities; 8. Monitoring the accuracy of measuring instruments;	Zo	3,5	Ocena wykonania ćwiczeń laboratoryjnych. Ocena sprawozdań z naciskiem na sformułowanie wniosków.
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	Ocena poszczególnych zadań programistycznych z zakresu metod numerycznych.
Rapid Prototyping (3D Printing)	K_W02, K_W03, K_U02.	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 printer; 7. Designing 3D models; 8. Building own solutions	Zo	2	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach.
Mechanics	K_W03, K_W07, K_W11, K_U02, K_U16, K_K02,	1. Newtons Laws of Motion; Projectiles and Charged Particles; 3.Momentum and Angular Momentum; 4.Energy; 5. Oscillations; 6.Calculus of Variations; 7.Lagranges Equations; 8TwoBody CentralForce Problems; 9.Mechanics in Noninertial Frames; 10.Rotational Motion of Rigid Bodies; 11.Coupled Oscillators and Normal Modes; 12. Nonlinear Mechanics and Chaos; 13. Hamiltonian Mechanics; 14 Collision Theory16. Continuum Mechanics	E	2	Ocena wykonania ćwiczeń laboratoryjnych.
Mobile Devices Programming	K_W04, K_W06, K_W10, 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	Ocena wykonania zadań programistycznych oraz ich skuteczności.
Embedded systems	K_W05, K_W08, 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. Interfaces: CAN, HART, ModBus; 12. External Memories; 13. RTOS – Real Time Operating System	Zo	3	Ocena realizacji ćwiczeń laboratoryjnych. Ocena aktywności na zajęciach
Artificial intelligence	K_W04, K_W06, 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	Ocena realizacji ćwiczeń laboratoryjnych.
Real-time operating system	K_W04, K_W06, K_U03	1. Introduction to real-time systems. 2. Introduction to the Building (BR) environment. 3. Advanced BR usage. Introduction to OpenWRT environment. 4. Execute advanced interprocess communication on Linux. 5. QEMU as a system modeling tool. Communication with Linux I/O devices, an essential introduction to driver development. 6. Advanced Linux adaptation techniques for real-time operation. 7. SOC and MPSoC - Real-time engagement utilizing FPGAs tightly integrated with the CPU. 8. Introduction to embedded drivers. 9. Organization of embedded driver software. 10. Design embedded driver software. 11. Sequencing tasks in real-time systems.	Zo	2	Ocena wykonania ćwiczeń laboratoryjnych w zakresie systemów operacyjnych czasu rzeczywistego
Control Systems Design	K_W05, K_W08, K_U08, K_U14,	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	Ocena wykonania ćwiczeń laboratoryjnych

Moduł B: Przedmioty obszarowe	Programmable Logic Controllers	K_W05, K_W08, 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	Egzamin pisemny. Ocena wykonania ćwiczeń laboratoryjnych, Ocena umiejętności pracy w grupie
	Network management	K_W04, K_W06, K_W10, K_W11, K_U02, K_U05, K_U14,	1. Policies, tools and methods for managing hardware and data on information networks; 2. Data Flow Management: VLANs, VLAN routing, load balancing routing, congestion avoidance, FQ queuing, WFQ, RED, WRED, CEF, Linux traffic shaping (CBq), improving connectivity performance (EtherChannel and LACP), and services (clusters); 2. Device management; SNMP protocols and tools, SNMPv2, SNMPv3, RMON solutions, MIB; 3. Network Access Management: 802.1X standard, Dynamic VLAN assignment, VPN (IPSec, PPTP, SSL), Firewall, IDS, and IPS, HoneyPot concept	Zo	2	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach.
	Electrical machines	K_W05, K_W08, 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	Ocena wykonania ćwiczeń laboratoryjnych.
	Modeling and simulation	K_W03, K_W07, K_U09	Introduction to subject. The idea of modeling. The concept of model. Classification of models. Simulation of natural systems. The steps in modeling systems. Cybernetic model and its modifications. Physical model. Examples of physical models of selected systems. Mathematical model. The general form of a mathematical model. Classification of mathematical models. Examples of mathematical models of selected systems. Simulation model. The process of constructing the simulation model. Introduction to modeling your storage systems (Queue theory). Staging processes. The mathematical model of birth and death. The model solution. Markowski's models of mass support. The application of queue theory. In computer systems performance studies. M/M/1 and M/M/c Loss Models. M/M/1/L type maintenance system model with waiting (queue). M/M/1/N support system model with full-size ticket source. Mass service models with priority queue rules. Comparative analysis of the modeling methods of the systems presented.	Zo	3	Ocena wykonania zadań na ćwiczeniach pod kątem prawidłowości działania opracowanych na zajęciach modeli
	Advanced Databases	K_W04, K_W10, K_U02,	1. Designing relational databases - revisited Notion of a key of relation, functional dependencies, Armstrong axioms, schema 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	Ocena wykonania ćwiczeń laboratoryjnych.
	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	Ocena realizacji ćwiczeń laboratoryjnych, ocena projektu.
	Web Applications Programming	K_W04, K_W06, K_W10, 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	Ocena wykonania zadań programistycznych, ocena umiejętności pracy w grupie poszczególnych członków zespołu..
	PDW: Fundamentals of machine operation	K_W16, K_U15,	1. Basic concepts and exploitation laws; 2. Machine operation systems; 3. Processes controlled and uncontrolled in operation - description of processes; 4. Ensuring serviceability, wear, damage; 5. Lubrication in the initial operation of cooperating elements, use of machines and repairs; 6. Operating documentation (DTR), virtual machine operation; 7. Connecting operation with the construction of machines and secretaries;	Zo	1	Kolokwium na ocenę
	PDW: Fundamentals of machine component design	K_W16, K_U15,	1. Welded joints 2. Welds and types of welds 3. Allowable stresses for welds, design cross-section of the weld 4. Tolerances and fits 5. Dimension tolerances and types of deviations 6. Bolted joints 7. Form-fit joints 8. Key and spline joints, bolt joints, clamping expansion joints, shaped machine shafts 9. Plain bearings, 10. Roller bearings 11. Belt transmissions 12. Geometric dependencies, tension in tendons and shaft loads 13. Gear transmissions 14. Springs;	Zo	1	Kolokwium na ocenę
	PDW: Industry Subject (AR technology)	K_W16, K_U03, K_U04, 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	Kolokwium na ocenę
	PDW: Industry Subject (VR technology)	K_W16, K_U03, K_U04, 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	Kolokwium na ocenę
	Power Electronics	K_W05, K_W08, K_U08,	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	3	Egzamin pisemny, Ocena aktywności na zajęciach, Ocena wykonania ćwiczeń.
	Components and Devices of Control Systems	K_W05, K_W08, K_U08, K_U14,	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	Ocena wykonania ćwiczeń laboratoryjnych

	Data transmission	K_W04, K_W06, K_U03,	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	Zo	2	Ocena wykonania ćwiczeń laboratoryjnych
	Advanced programming techniques (java or c #)	K_W04, K_W06, K_W10, 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	Ocena wykonania zadań programistycznych w ramach ćwiczeń laboratoryjnych.
	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	Ocena wykonania ćwiczeń laboratoryjnych. Ocena sprawozdań z naciskiem na sformułowanie wniosków.
	Expert classes	K_W16, K_U15,	The content of the lecture depends on the topic of the lecture, which the student selects individually.	Zo	1	Kołokwium na ocenę
	Programmable Logic Devices	K_W05, K_W08, K_U14, K_U15, K_U16,	1. Architecture and principle of programmable controllers; 2. Rules for connecting programmable controllers with objects; 3. Ladder language (LD) for Omron controllers; Bit control instructions. Logical instructions; Timers and counters; Data transfer and copying operations. Arithmetic shifts and circular shift registers. Data comparison; Subroutines. Program execution control; Calculations on binary numbers and in BCD. Data conversion; 4. Construction and operation of programmable relays; 5. User interface design and programming.	Zo	3	Ocena wykonania ćwiczeń laboratoryjnych, Ocena aktywności na zajęciach.
Praktyki	Internship "Employee competencies"	K_W17, K_U04, K_U11, K_U20, K_U21, 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	10	Ocena zeszytu praktyk, Ocena testu na platformie zdalnego nauczania
	Engineering internship	K_W17, K_U03, K_U04, K_U11, K_U20, K_U21, 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	20	Ocena zeszytu praktyk i realizacji programu praktyk
Proces dyplomowania	Engineering Project	K_W03, K_W05, K_W06, K_W07, K_W08, K_W09, K_W11, K_W12, K_U01, K_U02, K_U05, K_U06, K_U10, K_U12, K_U13, K_U17, K_U16, K_U18, K_K04, K_K07	Preparation of an engineering project adapted to the area of studies in the field of computer science nad mechatronics.	Zo	4	Ocena projektu inżynierskiego, aktywność na zajęciach.
	Preparation for the diploma exam	K_W12, K_U18, K_K01,	Explaining the issues related to the diploma exam and preparation for a public speech regarding engineering project.	Zo	2	Aktywność na zajęciach, ocena prezentacji projektu inżynierskiego.
	Diploma laboratory/ Diploma workshop	K_W11, 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	Aktywność na zajęciach, Ocena samodzielności realizacji zadań, pomiarów, konstrukcji, związanych z realizacją projektu inżynierskiego.